
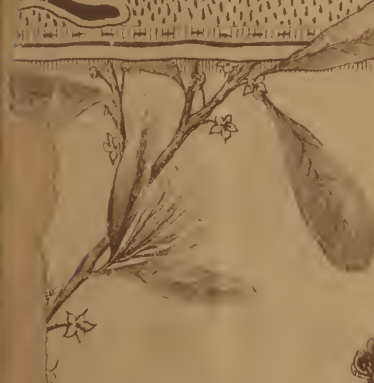


QV
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1885

COCA ERYTHROXYLON



ERYTHROXYLON COCA



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COCA ERYTHROXYLON

AND ITS DERIVATIVES.

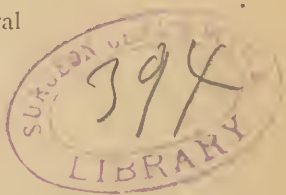
A *Résumé* of their History; Botanical Origin; Production and
Cultivation; Chemical Composition; Therapeutic
Application; Physiological Action;
and Medicinal Preparations.

—EMBRACING—

REPORTS ON THEIR EMPLOYMENT

—IN—

General and Minor Surgery; Ophthalmology; Otology; Laryngo-
logy; Gynæcology; Genito-Urinary, Nasal and Dental
Surgery; in the Treatment of the Alcohol
and Opium Habits; in General
Medicine; etc. etc.



COMPILED BY THE
SCIENTIFIC DEPARTMENT OF PARKE, DAVIS & CO.,
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ERYTHROXYLON COCA.

EXPLANATION OF PLATE.

This plate is a reproduction of that contained in Bentley and Trimen's well known work on "Medical Plants." The shrub which is, doubtless, indigenous to the mountainous districts near the west coast of South America, is extensively cultivated there, and also in the countries east of the Andes. A branch with young foliage and flowers is represented by Fig. 1. The flowers (Fig. 2) have a deeply five-lobed calyx (Figs. 4 and 5), five broadly-clawed petals provided with a ligula (Fig. 3), ten hypogynous stamens, and an ovoid ovary with three styles (Fig. 5), and divided into three cells (Fig. 7), of which two are usually abortive, so as to appear one-celled (Fig. 8). A longitudinal section of the ovary containing one ovule is shown in Fig. 6. The red fruit is drupaceous (Figs 9 and 10), and at its base is surrounded by the calyx and short tube of the stamens; a transverse section of it (Fig. 11) shows a thin sarcocarp and endocarp, which is filled by the seed, and this contains within a thin testa, the straight embryo and tough albumen. The shape of the stipules and their attachment between the petioles and branches is shown in Fig. 12, and the apex of a leaf in Fig. 13.

INTRODUCTION.

A simple narrative of facts regarding the Coca shrub and its derivatives, and especially of its alkaloid—Cocaine—and the wonderful rôle its preparations now play in practice would, it is believed, form a chapter in the history of medicine and surgery full of interest not only to the practical physician and surgeon, and the progressive therapist, but to all who recognize the importance of a drug which, through its stimulant properties, can supply the place of food, make the coward brave, the silent eloquent, free the victims of the alcohol and opium habits from their bondage, and, as an anæsthetic, render the sufferer insensitive to pain, and make attainable to the surgeon heights of what may be termed “æsthetic surgery,” never reached before.

It is the purpose of this compilation to present these facts for the convenience of the medical profession, thus exhibiting the wide range of application of the drug and its derivatives, and point out some of the most eligible preparations for its internal use and appliances for its external application, which have been placed before the profession.

HISTORY, PRODUCTION AND CULTIVATION.

HISTORY.*

Coca leaves are the produce of *Erythroxylon coca* (Lamarck), a shrub cultivated on the slopes of the Cordilleras of Bolivia, Peru, and Columbia. The Spanish conquerors of Western South America became well acquainted with the use of coca by the aboriginal Indians. Nicolas Monardes, a Spanish physician, published, at Seville, in 1565, a History of Medicinal Simples brought from the New World, in which he gives a description, obtained from the commentaries of Pedro Cieça and others, of coca leaves, their mode of collection and drying, and states they were the most important article of commerce, being used for barter or exchange in place of money among the South American Indians. He also describes their use of coca as being threefold. (1) It was chewed and mixed with the powder of calcined shells of oysters and other shellfish; this paste, after being allowed to ferment, was formed into boluses, or troches, and dried; during long journeys these boluses were sucked, and under their influence hunger and thirst were alleviated, and bodily strength was sustained. (2) When eaten for producing pleasure or intoxication, the coca was chewed by itself; and (3) it was mixed with tobacco and smoked. Among others, the following travelers have written on coca: Pöppig, Weddell, and Markham; of pharmacologists, Quincy, Pereira, and Hanbury do not mention it, nor has it been official till the last French Codex and United States Pharmacopœia. As a theme for the poet, Milton, who drew many of his similes from tropical plants and scenery, appears not to have known of it, as he does not mention it. Cowley, later, thus writes:

“ Our Varicocha first his Coca sent,
Endow'd with leaves of wondrous nourishment,
Whose juice suck'd in, and to the stomach ta'en,
Long hunger and long labor can sustain;
From which our faint and weary bodies find
More succor, more they cheer the drooping mind,
Than can your Bacchus and your Ceres join'd.
Three leaves supply for six days' march afford;
The Quitoita with this provision stor'd
Can pass the vast and cloudy Andes o'er.”

The coca shrub grows to a height of from four to eight feet, and resembles our black thorn in appearance. It has small white, short-stalked, drooping flowers, in clusters upon the branches in places where the leaves have fallen. The leaves are closely placed, alternate

* *London Lancet*, Dec. 13, 1884.

about two inches long, oval oblong, entire at the margin; sometimes they are acute, but usually blunt and emarginate, with a small apiculus in the notch at the apex, rather thin but opaque, smooth with a prominent midrib, and on each side a curved line running from the base to the apex, showing its mode of veneration. When fresh, the upper surface is bright dark-green in color, the lower is paler and strongly marked with veins. The carefully dried leaves have the odor of tea, but if dried less perfectly they have a bouquet of their own which is very unpleasant in the breath of those who chew it. They have a somewhat aromatic and bitter taste, and are more active when freshly dried. By permission we have tasted a fresh leaf in the Botanic Gardens, and the benumbing effect on the tongue—dulling its sensibility—was apparently much greater than that of a number of dried leaves.

The plants are raised from seeds, and the cultivation, at an elevation of from 2000 ft. to 7000 feet above the sea-level, is carried on with great care, as described by Dr. Weddell, who supposes the name *coca* to be derived from an Indian term signifying *the tree or plant*. Its original habitat is doubtful. It has been acclimatized in Ceylon. Botanical specimens were first sent by Joseph de Jussieu to his brother in 1750; these Antoine Laurent de Jussieu referred to the genus *erythroxylon*, and finally they served as types for Lamarck to give the plant his designation, "*Erythroxylon Coca*," in his "*Encyclopédie*." The coca shrub yields three or four crops of leaves annually, from the age of eighteen months to forty years. The produce has been estimated at from thirty to forty million pounds annually. Its value on the spot varies from amounts equal to from one to five shillings per pound English. The most productive plantations, or "*cocals*," are in the province of La Paz in Bolivia, but our principal imports come from Lima.

Coca was used in the religious rites of the Incas; it was by them treated with great reverence, and by their conquerors with some superstition. A council of bishops at Lima in 1569 condemned its use, and stated that the belief entertained by the Indians that the habit of chewing coca gave them strength was an illusion of the devil. By the Indians working as miners or at other occupations, coca is still chewed with a paste made of the ashes of certain plants or with lime. They become more or less slaves to the habit; opinions differ as to the ill-effect of this chewing. On Europeans who became accustomed to it, but had not been addicted to its use from youth, Dr. Weddell noticed that it did sometimes produce evil consequences, and that in some a peculiar aberration of the intellectual faculties occurred, indicated by hallucinations. His view of its action was that it deceived or lulled hunger and fatigue. The Indians who accompanied him on his journey chewed coca during the whole day, but at night they filled their stomachs like fasting men. Dr. Mantegazza, of Milan, who practiced in South America, further tried and wrote on its marvellous properties, as did Sir Robert Christison. Mr. G. Dowdeswell also tried it, but came to negative conclusions as to its action. Except by the force of advertisements of French specialties made from it, coca has of late received but little attention in England; but now, again, the observations of Herr Koller on the local anæsthetic action possessed by its alkaloid, cocaine, have brought it to the front.

The alkaloid cocaine was produced by Niemann, in 1860, from the leaves of the *Erythroxylon coca*. Professor Schroff was probably the first to mention the fact of its anæsthetising effect on the mucous membrane of the tongue. The credit of rescuing cocaine from the oblivion into which it had fallen, and on giving it a practical application, unquestionably belongs to Koller. The great excellences of cocaine consists in the limitation of its action to the tissues to which it is applied. No doubt other symptoms at a distance do result from the external application of the anæsthetic, but they are for the most part insignificant and by no means dangerous. In some measure cocaine may be compared with curare. The one agent paralyzes the termination of the sensory nerves, while the other paralyzes the termination of the motor nerves. Aconite would seem to act in a manner the very reverse of cocaine. The contemplation of a few facts of this kind leads us to think of the Ultima Thule

of anæsthetics as likely to be not one of the least splendid triumphs of science. No doubt much remains to be worked out before the full value is given to this latest addition to our armamentaria, and before a full explanation of the mode of action of the drug in the one particular respect for which it is in so great a demand can be given.

The coca-leaf is the great source of comfort and enjoyment to the Peruvian Indian; it is to him what betel is to the Hindu, kava to the South Sea Islander, and tobacco to the rest of mankind; but its use produces invigorating effects which are not possessed by the other stimulants. From the most ancient times, the Peruvians have used this beloved leaf, and they still look upon it with a feeling of superstitious veneration. In the time of the Yncas it was sacrificed to the sun, the Huillac Umu or high-priest chewing the leaf during the ceremony; and before the arrival of the Spaniards, it was used as the cacao in Mexico, instead of money. After the conquest, although its virtues were extolled by the Ynca Gracilasso de la Vega, and by the Jesuit Acosta, some fanatics proposed to proscribe its use, and to root up the plants because they had been used in the ancient superstitions, and because its cultivation took away the Indians from other work. The second Council of Lima, consisting of bishops from all parts of South America, condemned the use of coca in 1569, because it was a useless and pernicious leaf, and on account of the belief stated to be entertained by the Indians that the habit of chewing coca gave them strength, which is an illusion of the devil."

In speaking of the strength the coca gives those who chew it, Carcilasso de la Vega relates the following anecdote: "I remember a story which I heard in my native land of Peru, of a gentleman of rank and honor named Rodrigo Pantoja, who, travelling from Cuzco to Rimac (Lima), met a poor Spaniard (for there are poor people there as well as here), who was going on foot with a little girl aged two years on his back. The man was known as Pantoja, and they thus conversed: 'Why do you go laden thus?' said the knight. The poor man answered that he was unable to hire an Indian to carry the child, and for that reason he carried it himself. While he spoke Pantoja looked in his mouth and saw it was full of coca; and as the Spaniards abominate all that the Indians eat and drink, as though it savored of idolatry, particularly the chewing of coca, which seems to them a low and vile habit, he said: 'It may be as you say, but why do you eat coca like an Indian, a thing so hateful to Spaniards?' The man answered: 'In truth, my lord, I detest it as much as anyone, but necessity obliges me to imitate the Indians and keep coca in my mouth, for I would have you know that if I did not do so I could not carry this burden, while the coca gives me sufficient strength to endure the fatigue.' Pantoja was astonished to hear this, and told the story wherever he went, and from that time credit was given to the Indians for using coca from necessity and not from vicious gluttony."

The Spanish Government interfered with the cultivation from more worthy motives, and *mitas* of Indians for the purpose of collecting coca leaves were forbidden in 1569, owing to the reputed unhealthiness of the valleys.

Finally, Don Francisco Toledo, Viceroy of Peru, permitted the cultivation with voluntary labor, on condition that the Indians were well paid, and that care was taken of their health. This most prolific of Peruvian legislators issued no less than 70 *ordenanzas* on this subject alone between the years 1570 and 1574. Coca has always been one of the most valuable articles of commerce in Peru, and it is used by about 8,000,000 of the human race.

The coca plant (*Erythroxylon Coca*) is cultivated between 5,000 and 6,000 feet above the level of the sea, in the warm valleys of the Eastern slopes of the Andes, where almost the only variation of climate is from wet to dry, where frost is unknown, and where it rains more or less every month in the year. It is a shrub from four to six feet high, with lichens, called *lacco* in Quichua, usually growing on the older trunks.

The branches are straight and alternate, leaves alternate and entire, in form and size like tea leaves; flowers solitary, with a small, yellowish-white corolla, in fine petals, ten filaments the length of the corolla, anthers heart-shaped, and three pistils.

PRODUCTION AND CULTIVATION.*

Sowing is commenced in December and January, when the rains begin, which continue until April. The seeds are spread on the surface of the soil in a small nursery or raising ground called *almaciga*, over which there is generally a thatch roof (*huasichi*). At the end of about a fortnight they come up; the young plants being continually watered, and protected from the sun by the *huasichi*. The following year they are transplanted to a soil specially prepared through weeding and breaking up the clods very fine by hand, often in terraces kept up by small stone walls, only affording room for a single row of plants, up the sides of the mountains. The plants are generally placed in square holes called *aspi*, a foot deep, with stones on the sides to prevent the earth from falling in. Three or four are planted in each hole, and grow up together. In Caravaya and Bolivia, the soil in which the coca grows is composed of a blackish clay, resulting from the decomposition of the schists, which form the principal geological features of the mountains. On level ground the plants are placed in furrows called *uachos*, separated by little walls of earth (*umachos*), at the foot of each of which a row of plants is placed; but this is a modern innovation, the terrace cultivation being the most ancient. At the end of eighteen months the plants yield their first harvest, and continue to yield for upwards of forty years. The first harvest is called *quita calzon*, and the leaves are then picked very carefully, one by one, to avoid disturbing the roots of the young, tender plants. The following harvests are called *mita* ("time" or "season"), and take place three times and even four times in the year. The most abundant harvest takes place in March, immediately after the rains; the worst at the end of June, called the *mita de san Juan*. The third called *mita de Santos* is in October or November. With plenty of watering, forty days suffice to cover the plants with leaves afresh. It is necessary to weed the ground very carefully, especially while the plants are young. The harvest is gathered by women and children.

The green leaves called *matu* are deposited in a piece of cloth which each picker carries, and are then spread out in the drying yard, called *matu-cancha*, and carefully dried in the sun. The dried leaf is called *coca*. The drying yard is formed of slate flags called *pizara*; and when the leaves are thoroughly dry, they are sewn up in a *cestos* or sacks made of banana leaves, of twenty pounds each, strengthened by an exterior covering of *bayeta* or cloth. They are packed in *tambores* of fifty pounds each, pressed tightly down. Dr. Pöppig reckoned the profits of a coca farm to be forty-five per-cent.

The harvest is greatest in a hot, moist situation; but the leaf generally considered the best flavored by consumers grows in drier parts, on the sides of hills. The greatest care is required in the drying; for too much sun causes the leaves to dry up and lose their flavor, while if packed up moist they become fetid. They are generally exposed to the sun in thin layers.

Acosta says that in his time the trade in coca at Potosi was worth 500,000 dollars annually, and that in 1583 the Indians consumed 100,000 *cestos* of coca, worth $2\frac{1}{2}$ dollars each in Cuzco, and four dollars in Potosi. In 1591, an excise of 5 per cent. was imposed on coca; and in the years 1746 and 1750 this duty yielded 800 and 500 dollars respectively from Caravaya alone. Between 1785 and 1795, the coca traffic was calculated at 1,207,430 dollars in the Peruvian viceroyalty; and including that of Buenos Ayres, 2,641,487 dollars.

In the district of Sandia, in Caravaya, there are two kinds of coca, that of Ypara and that of Hatunyunca, which has a larger leaf. The yield is 45,000 *cestos* a year. In the yungus of La Paz in Bolivia, the yield is about 400,000 *cestos*. The coca trade is a government monopoly in Bolivia, the state reserving the right of purchasing from the grower, and

* *American Druggist*, May, 1881.

re-selling to the consumer. This right is generally farmed out to the highest bidder. In 1850, the coca duty yielded 200,000 dollars to the Bolivian revenue.

The approximate annual produce of coca in Peru is about 15,000,000 lbs., the average yield being about 800 pounds an acre. More than 10,000,000 lbs. are produced annually in Bolivia, according to Dr. Booth of La Paz, so that the annual yield of coca throughout South America, including Peru, Bolivia, Ecuador, and Pasto may be estimated at more than 30,000,000 lbs. At Tacnar, the tamber of 50 lbs. is worth 9 to 12 dollars, the fluctuations in price being caused by the perishable nature of the article, which cannot be kept in stock for any length of time. The average duration of coca in a sound state, on the coast, is about five months, after which time it is said to lose flavor, and is rejected by the Indians as worthless.

The reliance on the extraordinary virtues of the coca-leaf amongst the Peruvian Indians is so strong that, in the Huanuco province, they believe that if a dying man can taste a leaf placed on his tongue, it is a sure sign of his future happiness.

No Indian is without his *chuspa* or coca bag, made of llama cloth dyed red and blue in patterns, with woolen tassels hanging from it. He carries it over one shoulder, suspended at his side, and in taking coca he sits down, put his *chuspa* before him, and places the leaves in his mouth one by one, chewing and turning them till he forms a ball. He then applies a small quantity of carbonate of potash, prepared by burning the stalk of the quinoa plant (*Chenopodium quinoa*), and mixing the ashes with lime and water, thus forming cakes called *llipta*, which are dried for use and also kept in the *chuspa*. This operation is called *acullicar* in Bolivia and Southern Peru, and *chucchar* in the north. They usually perform it three times in a day's work, and every Indian consumes two or three ounces of coca daily.

In the minds of the cold regions of the Andes, the Indians derive great enjoyment from the use of coca; the running *chasqui* or messenger in his long journeys over the mountains and deserts, and the shepherd watching his flock on the lofty plains has no other nourishment than is afforded by his *chuspa* of coca and a little maize. The smell of the leaf is agreeable and aromatic, and when chewed gives out a grateful fragrance, accompanied by a slight irritation, which excites the saliva. Its properties are to enable a greater amount of fatigue to be borne with less nourishment, and to prevent the difficulty of respiration in ascending steep mountain sides. Tea made from the leaves has much the taste of green tea, and if taken at night is much more effectual in keeping people awake. Applied externally, coca moderates the rheumatic pains caused by cold, and cures headaches. When used to excess it is, like everything else, prejudicial to the health, yet, of all the narcotics used by man, coca is the least injurious, and the most soothing and invigorating.

The active principle of the coca leaf was separated by Dr. Niemann, and called *cocaine*. Pure cocaine crystallizes with difficulty, is but slightly soluble in water, but is easily dissolved in alcohol, and still more easily in ether.

I chewed coca, not constantly, but very frequently, from the day of my departure from Sandia, and, besides the agreeable soothing feeling it produced, I found that I could endure long abstinence from food with less inconvenience than I should otherwise have felt, and it enabled me to ascend precipitous mountain sides with a feeling of lightness and elasticity, and without losing breath.

This latter quality ought to recommend its use to members of the Alpine Club, and to walking tourists in general, though the sea voyage probably causes the leaves to lose much of their virtue.

To the Peruvian Indian, however, who can procure it within a few weeks of its being picked, the coca is a solace which is easily procured, which affords great enjoyment, and which has a most beneficial effect.

BOTANICAL ORIGIN, CHEMICAL COMPOSITION, AND PHYSIOLOGICAL ACTION.

BOTANICAL ORIGIN.

Report from the U. S. Dispensatory (Fourteenth Edition), page 1643: *Erythroxylon Coca* (Lamarck). This is a shrub growing wild in South America, and largely cultivated in Bolivia for the sake of its leaves, which are much used in that country as a masticatory. The plant, which is propagated from the seed in nurseries, begins to yield in eighteen months, and continues productive for half a century. The leaves, on being picked, are dried in the sun, and packed in bags. They are known in South America by the name of coca. They were in general use among the natives of Peru at the time of the conquest, and have continued to be much employed to the present time. According to Von Bibra 30,000,000 lbs. are at present annually produced. (Pharm. Journ. and Trans., July, 1870, p. 43; also Med. Times and Gaz., vol. ii, 1871, p. 407.)

The leaves resemble in size and shape those of tea, being oval-oblong, pointed, two inches or more in length, by somewhat over an inch in their greatest breadth, and furnished with short, delicate foot-stalks; but they are not, like the tea-leaves, dentate, and are distinguished from most other leaves by a slightly curved line on each side of the midrib, running from the base to the apex. When well dried, they have an agreeable odor resembling that of tea, and a peculiar taste, which, in decoction, becomes bitter and astringent. Some attempts were made to analyze coca before the publication of the eleventh edition of this Dispensatory, of which the main result was, that the leaves contained a peculiar very bitter principle on which their virtues probably depended. M. Stanislas Martin afterwards made a hasty examination, from which it appeared that they contain a peculiar bitter principle, resin, tannin, an aromatic principle, extractive, chlorophyll, a substance analogous to them, and salts of lime. (Journ. de Pharm, April, 1859, p. 283.) Dr. Albert Nieman, of Goslar, has made a more thorough investigation of the leaves, and succeeded in isolating a peculiar alkaloid, to which he gave the name of cocaina. The following was his process: The leaves were exhausted with 85 per cent. alcohol acidulated with 2 per cent of sulphuric acid; the tincture was treated with milk of lime and filtered; the filtrate was neutralized with sulphuric acid, and the alcohol distilled off. The syrupy residue was treated with water to separate resin, and then precipitated by carbonate of sodium. The deposited matter was exhausted by ether, and the ethereal solution, after most of the ether had been distilled, was allowed to evaporate spontaneously. The cocaina was thus obtained in colorous crystals, mixed with a yellowish-brown matter of a disagreeable odor, which was separated by washing with cold alcohol. Pure cocaina is in colorless transparent prisms, inodorous, of a bitter taste, soluble in 704 parts of cold water, more soluble in alcohol, and freely so in ether. The

solution has an alkaline reaction, and a bitterish taste, leaving a peculiar numbness on the tongue, followed by a sensation of cold. The alkaloid melts at 208°F. , and on cooling congeals into a transparent mass, which gradually becomes crystalline. Heated above this point it changes color, and is decomposed. It is inflammable, burning with a bright flame, and leaving charcoal. With the acids it forms soluble and crystallizable salts, which are more bitter than the alkaloid itself. It was found to consist of carbon, hydrogen, nitrogen, and oxygen; and the formula as given by Dr. Nieman is $\text{C}_{32}\text{H}_{20}\text{NO}_3$. He also obtained wax, a variety of tannic acid (*cocatannic acid*), and a concrete volatile odorous substance. (See *Am. Journ. of Pharm.*, March, 1861, p. 122.) Prof. Maisch, of Philadelphia, succeeded in obtaining from the leaves an uncrystallizable alkaloid, having so nearly the properties of cocaina that he considered it merely as the result of the action of heat on the crystallizable principle. (*Ibid.*, Nov., 1861, p. 500.) Still more recently M. Lossen has examined cocaina, and ascertained that, when heated with muriatic acid, it splits into benzoic acid and a new base which he calls ecgonin. The mutability of cocaina with acids, explains why the attempts to extract the alkaloid with acid liquids have failed. M. Lossen therefore recommends the omission of acid in operating on the leaves, and proposes the following modification of Niemann's plan: An infusion is first made; this is precipitated with acetate of lead; the lead is removed by sulphate of sodium; the liquid is concentrated, carbonate of sodium added, and the whole shaken with ether. The ether extracts the alkaloid, and yields it in a crude state by evaporation. It is then purified as in the process of Dr. Niemann.

CHEMICAL COMPOSITION.

The most important constituent of the coca leaf is an alkaloid which was first discovered in 1855 by Garedeke, and named by him erythroxyline, but now commonly known as cocaina, or cocain. Its composition is $\text{C}_{17}\text{H}_{21}\text{NO}_4$. It crystallizes in colorless prisms which have a strong alkaline reaction, and a bitterish taste, producing transient numbness of the tongue. It is freely soluble in alcohol and ether, sparingly so in cold water (one part in seven hundred).

The leaves also contain a peculiar tannin, called coca tannic acid, which produces with iron salts a green color, and a second, volatile alkaloid, named by Lossen hygrina. This is described as a dense yellowish oily liquid, having a burning taste, a strong alkaline reaction, and an odor resembling that of trimethylamina.

PHYSIOLOGICAL ACTION.

Dr. P. Livierato, in *La Salute*, III, 1885, arrives at the following conclusions relative to the physiological and therapeutic effects of cocaine:

1. Cocaine, even in small doses, has a recognizable effect upon the peripheral nerves when subcutaneously injected.
2. Small doses (one third of a grain) are able, in some instances, to diminish local sensibility, and to relieve local pain.
3. Larger doses (one and a half grains) may produce complete anæsthesia of all sensibility in a comparatively wide area.
4. Cocaine subcutaneously injected has, besides its local action, an effect upon the circulation.
5. Such action is manifested by doses of one-sixth of a grain, and much more plainly by doses ranging from two-thirds of a grain to a grain and one-half.
6. The frequency of the pulse is increased ordinarily in proportion to the size of the dose, by a few pulsations up to eight and even fourteen during the first minute.

7. The intra-arterial pressure is lowered in most cases from a few millimetres to twenty, according to the individual and independent of the dose.

8. The ascending sphygmographic curve under the action of the drug is lowered, and the descending curve becomes very short.

9. Respiration does not undergo any modification worthy of remark from the administration of doses ranging from one-sixth of a grain to one grain and a half of cocaine.

10. Its action in healthy individuals begins to be manifested within from three to five minutes after the injection, according to the dose. Its action may endure from twenty minutes to more than one hour.

11. Cocaine is capable of diminishing and removing all neuralgic pain.

12. Such effect is not only local, but is exercised at a point remote from that at which injection was practiced.

13. The anæsthetic action commences a few minutes after the injection, and continues from one and a half to six hours, according to the dose.

14. Cocaine does not produce any general phenomena in doses ranging from one-sixth of a grain to a grain and a half.

15. The subcutaneous injection of the above doses does not produce mydriasis.

Dr. H. M. Biggs, of New York, publishes, in a late number of the *Journal of the American Medical Association*, a valuable article upon this subject, which is founded on a series of experiments conducted by the author in the physiological laboratory at Berlin. Twenty-one experiments are minutely described, and carefully prepared tables are added. The writer summarizes the results of his experiments thus: "In conclusion, then, the action of cocaine on the frog may be summed up as follows: 1. It has a powerful local anæsthetic action on the skin, the mucous membrane, and the eye. It usually produces mydriasis. 2. It has a depressant action on the heart, reduces the force and frequency of its pulsations, and finally paralyzes it (first the ventricles and then the auricles) in diastole. 3. In small doses it at first slightly increases the number of the respirations, then decreases it, and in large doses diminishes it rapidly from the first, finally causing death from a paralysis of respiration. 4. It at first slightly heightens and then greatly depresses the reflex action of the spinal cord in small doses. Large doses depress from the first. 5. Small doses at first slightly increase the irritability of the sensory nerves, then depress their irritability, and large doses depress from the first. 6. Both large and small (not very small) doses have a depressant action on the motor nerves. 7. It paralyzes the pneumogastric nerve. 8. Doses of moderate size diminish the excitability of the striated muscles. 9. The local application of cocaine to any of the more highly constituted organs or tissues causes a temporary cessation of their functional activity. 10. From the local and constitutional action on the different organs and tissues, it is rendered probable that its general action is a local one, exercised on all parts for which it has a chemical affinity, through its presence in the blood. The results of these experiments would seem to indicate the use of cocaine in tetanus and strychnine poisoning."

Mantegazza in 1859 was probably the first to carefully study the effects of the coca. He used the leaves procured from Bolivia and experimented with the juice of the same obtained by chewing them. His conclusions were:

1. Coca has on the stomach a special stimulating action, by which digestion is made very easy.

2. In strong doses it increases temperature, pulse, and respiration, and may even cause real fever.

3. Its use may be followed by a slight constipation.

4. In doses of from one to four drachms it excites the nervous system in such a way

that muscular exercise is followed with less fatigue, and with a considerable resistance against external disturbing influences.

5. In larger doses it causes hallucinations and delirium.

6. It probably diminishes some of the secretions.

From these experiments it would seem that coca promotes digestion by stimulating the acid gastric follicles, for when the drug is taken into an empty stomach it produces acid eructations.

Dr. Alexander Bennett was perhaps the first in England to carefully study the effects of the drug. After a large number of experiments on animals his conclusions are:

1. The physiological actions of coca, tea, coffee, guarana, are mainly, if not entirely, due to their neutral principles.

2. Cocaine, theine, caffeine, guaranine, and theobromine are powerful poisons, inducing a series of symptoms affecting the nervous, respiratory, circulatory, vaso-motor, and glandular systems, which terminate, if the dose be large enough, in death.

3. These five principles are, to all appearances, identical in physiological action.

4. In small doses, not ending fatally, these five substances produce, *a*, cerebral excitement not succeeded by coma, and, *b*, partial loss of sensibility.

5. In large doses they produce:

a. Cerebral excitement.

b. Complete paralysis of sensibility.

c. Tetanic spasms and convulsions.

d. Death.

6. They paralyze the entire posterior columns of the spinal cord, also the entire system of peripheral sensory nerves; but the anterior columns and the peripheral motor nerves are not paralyzed.

7. They frequently produce convulsions of a clonic character, but occasionally they cause tetanic spasms; which latter are sometimes so severe as to induce opisthotonos.

8. They do not produce muscular paralysis.

9. They at first increase, then impede, and lastly stop the respiration.

10. They at first increase, and finally diminish both the force and frequency of the heart's contractions.

11. They produce at first contraction, and afterwards dilatation, of the capillaries and small blood vessels, with stasis of the blood, indicating first irritation, and subsequent paralysis of the vaso-motor nerves.

12. They affect the temperature by first slightly lowering, and secondly increasing it.

13. They usually produce contraction of the pupil.

14. They produce an increase of the salivary secretion.

15. They induce a peculiar form of tenesmus, accompanied by a copious discharge of clear mucous from the bowels.

Von Tschudi says the chewing of coca gives a bad breath, pale lips and gums, greenish and stumpy teeth, and an ugly black mark at the angles of the mouth. The unsteady gait, the yellow skin, the dim and sunken eyes encircled by a purple ring, the quivering lips and general apathy all bear evidence of the baneful effects of the coca juice when taken in excess. But after summing up his inquiries, he says: "Setting aside all extravagant and visionary notions on the subject, I am clearly of the opinion that the moderate use of coca is not merely innocuous, but that it may even be conducive to health."

Dr. Isaac Ott, in the *New York Medical Record*, September 6, 1876, gives the results of his experiments with the drug, finding that "coca, on man, increases the pulse, elevates the temperature, dilates the pupil, and decreases the amount of water used and chloride of sodium excreted by the kidneys."

The chief difference in the conclusions arrived at by these two eminent experimenters

(Drs. Ott and Bennett) from their observations on animals, is in the effect of the drug on the eye. Dr. Bennett believes it to contract the pupil, while Dr. Ott found dilatation of the pupil followed its administration; this latter we know, by subsequent investigation, to be the usual result.

Most of the observers who have studied its effects on the elimination of urea, agree that it diminishes the quantity excreted, though Gazeau, in a series of experiments on animals, found the quantity increased.

Schroff, Frommüller, and Ploss believe the drug to have decided narcotic properties, while at the same time, from large doses, they noticed dizziness and tinnitus aurium, and by some observers (Anrep) a curious pendulum movement of the body of the animal has been noticed after large doses.

From a consideration of the physiological effects of the drug it is evident that it possesses remarkable power over the nervous system, affecting not only the peripheral system of sensory nerves, but portions of the spinal cord and brain; and it is in disorders of the nervous system that perhaps the most benefit is to be derived from its use.

If it be true, as is apparent from most of the experiments thus far reported, that it prevents tissue metamorphosis and is in a sense a nerve food, in that it stimulates and nourishes the nervous system without that reaction which follows the administration of all the other drugs of the class to which it belongs, it will prove to be of inestimable value to those persons who are obliged for long periods to subsist upon insufficient quantities of food and bear much exposure, as, for example, soldiers in the field, and sailors at sea. It may also be of decided benefit to those travelers who ascend steep and high mountains.

At this point the question arises as to the propriety or safety of placing the drug in the hands of the laity for miscellaneous use. While there can be no doubt of the wisdom of the rule that no drug should be used promiscuously by the public, yet it is possible to conceive of circumstances under which the general use of a drug like coca might be beneficial. It is doubtful whether the habit of coca chewing (among those who are not hereditary predisposed to its use) would be formed even if its use were as free to the public as tea or coffee, and even if formed, I doubt whether the bad effects of the habit would be as marked as some writers would have us believe.

Dr. Eber Caudwell thus writes in the *British Medical Journal*, January 3, 1885:

The following observations made on myself were undertaken at the suggestion of Dr. Murrell, with the view of ascertaining whether coca or its alkaloid possessed any toxic action. The first series was made with valoid of coca, a fluid extract, each part of which corresponds to an equal weight of the leaves of the coca plant. On December 9th, at 2 p.m., being busily engaged in seeing out-patients, I took two drachms in water, and experienced nothing but a little frontal headache. On the 9th, at 7 p.m., after a hard day's work, I took three drachms, and almost immediately fell into a deep sleep, which lasted four hours. On the 13th, I took five drachms at bed-time, slept for two hours, and then passed a restless night. On the 16th, I took a fluid ounce at bed-time, and was kept awake all night. There was a general feeling of well-being, with considerable mental excitement, and I was able to read steadily for many hours. On the 18th, I took two ounces at midnight, suffered severely for ten minutes from giddiness and unsteadiness of gait, and then experienced the same sensations as on the previous evening. There was renewed mental and physical activity, and I felt that any exertion could have been undertaken without difficulty.

My next observations were made with the hydrochlorate of cocaine, a supply of which was kindly placed at our disposal by Mr. E. Merck, of Darmstadt. Half a grain, taken by mouth at bed-time, produced drowsiness; a grain induced sleep, followed by persistent insomnia; two grains and a half gave rise to frontal headache, great mental excitement, and marked insomnia. Failing to produce any decided toxic effect, I took, at 7 p. m. on the 20th, a single dose of three grains, I had just come off a long railway journey, and

had purposely abstained from food for nearly twenty-four hours. At first I felt decidedly sleepy, and there was slight vertigo; but these symptoms soon passed away, and, in the course of an hour, I felt perfectly fresh and well, and remained awake all night. At 10:30 on the following morning, I took five grains more, and then felt that a decided effect had been produced. In a few minutes I was so giddy I could hardly stand, and was quite unable to make any exertion. There was a slight supra-orbital headache, and a feeling of weight or sinking at the pit of the stomach. The pupils were widely dilated, and I could hardly see. My temperature was taken four times, and was found to vary from 96.7° to 98.6° . The pulse, for a few minutes, rose to 94, but, as a rule, was not above 80. The urine passed at the time had a specific gravity of 1020, and was normal. In about two hours, the unpleasant sensations passed off, and I walked to the hospital, a distance of four miles, in something under fifty minutes. By one o'clock I was quite myself again, and was as fresh and vigorous as ever. The dilatation of the pupils continued for six hours. From these observations I conclude:

1. That coca and cocaine exert a double action, acting as cerebral sedatives in small doses, and as cerebral stimulants in large doses.

2. That cocaine, given internally, dilates the pupils.

3. That cocaine, unless in large doses, possesses no toxic action.

Dujardin-Beaumetz has noticed the occurrence of syncope in several cases after the hypodermic injection of weak solutions of this drug. He believes it due to cerebral anæmia, and says it will not take place if the patient be kept in a horizontal posture.

APPLICATION IN MEDICINE AND SURGERY, AND ELIGIBLE PREPARATIONS FOR INTERNAL, TOPICAL, AND HYPODERMIC USE.

An enumeration of the diseases in which coca and cocaine have been found of service would include a category of almost all the maladies that flesh is heir to. The medical press teems with reports of its efficacy in such a variety of affections that the sanguine might think it not too much to suppose that in coca and its derivatives the universal panacea for human ills had at last been discovered.

Allowing for the exaggeration of enthusiasm, it remains the fact that already cocaine claims a place in medicine and surgery equal to that of opium and quinine, and coca has been held to be better adapted for use as a popular restorative and stimulant than either tea or coffee.

A writer in the *Centralblatt für Klinische Medicine* thus summarizes the therapeutic application of cocaine.

1. As a stimulant if one wishes to do extra physical or mental work.
2. In gastric indigestion.
3. In the cachexiae.
4. In combating the effects of morphine and alcohol.
5. In asthma.
6. As an aphrodisiac.
7. As a local anæsthetic.

Its utility has thus far been more fully demonstrated as a local anæsthetic than in any other rôle. It is certainly the best agent at the command of the physician or surgeon in facilitating minor surgical procedures, examinations, and operations of every variety. It has proved a boon not alone to the ophthalmologist, the otologist, the laryngologist, the gynæcologist, the rhinoscopist, the dermatologist, the dental surgeon, and the genito-urinary surgeon, but also to the general practitioner. (For clinical reports of the use of coca and cocaine in general practice and in special branches of practice, see pages 89 to 92 of this pamphlet.)

ELIGIBLE PREPARATIONS OF COCA AND COCAINE, AND APPLIANCES FOR THEIR CONVENIENT ADMINISTRATION AND APPLICATION.

Among these may be mentioned the following, which, it is believed, embrace all that will be needed by physicians and surgeons to meet the requirements of practice:

Fluid extract coca.*	Cocaine citrate solution, 4 per cent.*
Wine of coca.*	Cocaine hydrobromate pure in crystals.*
Coca cordial.*	Cocaine hydrobromate solution, 4 per cent.*
Coca cheroots.*	Cocaine muriate, pure in crystals.*
Coca cigarettes.*	Cocaine muriate solution, 2 per cent.*
Cocaine inhalent.*	Cocaine muriate solution, 4 per cent.*
Cocaine oleate, 5 per cent.*	Cocaine salicylate solution, 4 per cent.*
Cocaine alkaloid.*	

In addition to these preparation there has been presented a very complete cocaine case,* containing every essential for the topical application of cocaine, including a hypodermic syringe, camel's hair pencil, a minim pipette, a vial to contain a solution of cocaine muriate, five capsules, each containing one grain of cocaine muriate in crystals, and a card containing directions for making a 2 per cent. and 4 per cent. solution of muriate of cocaine.

Although the applications of the various preparations of cocaine will no doubt be suggested to the intelligent physician, we venture, nevertheless, to mention in a general way a few facts regarding the special adaptability of some of them for use in particular classes of disease.

Thus it is evident that the fluid extract of coca, wine of coca, and coca cordial are best adapted for oral administration; the solutions of the salts for topical and hypodermic use for anæsthetic purposes; the cocaine oleate for treatment of neuralgia of superficial nerves, or for anæsthetizing a sensitive tooth for filling; the cheroots and cigarettes and cocaine inhalent for affections of the respiratory tract, spasmodic cough, bronchitis, etc.

COCA-LEAF CIGARS AND CIGARETTES.†

I have been experimenting for some time with the leaf of erythroxylon coca in the form of a cigar—first, for the purpose of ascertaining whether the drug would thus produce its physiological effects, and, secondly, in view of a new therapeutic application. It is too soon yet to express a positive opinion in regard to the latter, but I have had sufficient experience with them to say something about the former; and as I find that others are already commencing to enter this field, I may be excused for calling the attention of the profession at this early date, my excuse being that I wish to receive what credit may accrue from my share in their introduction.

Some time after I commenced my experiments, I found that Dr. Louis Lewis of this city, was employing coca in the form of a cigarette in the treatment of throat affections with success, and, as he says he has been using the drug in this way for nine years, he is entitled certainly to the credit of priority.

Dr. Lewis' cigarettes are composed partly of coca- and partly of tobacco-leaf. This has its advantages and disadvantages. Without discussing this point, however, I employ a cigar made of pure coca-leaf, with a wrapper of mild imported tobacco of fine quality, and a cigarette of pure coca-leaf containing no tobacco, wrapped with the best quality of rice-paper. Those who do not object to the tobacco can use the cigars, while those who have objections to it can employ the cigarette; while for those who object to the tobacco wrapper and the paper wrapper also I prepare a "smoking tobacco," of the pure coca-leaf, without admixture of any kind, which may be smoked in a pipe.

Coca is too well-known to the profession to make it necessary for anything more than the briefest description of the plant, its history, or its virtues.

* Manufactured by Parke, Davis & Co., Manufacturing Chemists. Descriptive circulars, etc., mailed on application.

† F. E. Stewart, M. D., Ph. G., in *Philadelphia Medical Times*, Sept. 19, 1885.

The erythroxyton coca grows in moist and woody regions on the eastern slope of the Andes, from 2,000 to 10,000 feet above the level of the sea, and is highly valued and cultivated by the natives of Peru, Chili, and Bolivia, who make great use of it as a medicine and as an article of diet. It answers as a substitute for the tea, coffee, tobacco, hashish, opium, etc., of other nations. The natives masticate the dried leaves with finely-powdered chalk, or with a highly alkaline substance prepared from roasted potatoes and the ashes of various plants and which they call *llipta*. It is said that its use enables them to endure fatigue and exertion for many hours, and even for many days, with but little nourishment of any other kind, and while under its influence they are said to perform prodigies of labor.

Let me compare, therefore, the action of these cigars with that said to be produced by the drug, not only by the natives, but by Bartholow, Wood, the United States Dispensatory, the National Dispensatory, and other authorities equally well known, who are investigating the properties of this remarkable drug.

First, all authorities agree that the use of coca, either in the leaf, fluid extract, or wine, is followed by a feeling of contentment and of well-being, the sense of fatigue is removed, drowsiness is experienced for a brief period, but is soon followed by wakefulness and increased mental activity. The celebrated pedestrian Weston, having learned their powers, was detected in the use of coca-leaves during one of his extraordinary feats in London. The question then, is, does coca, smoked, produce these effects?

I have testimony as to the feeling of contentment and well-being. Dr. M., of Wilmington, Delaware, one of the leading physicians of that State, made some experiments in this direction for me. Being thoroughly acquainted with the effect of the drug, having frequently used it in connection with his extensive practice, and often experienced its effects on himself, what he has to say must be received as of weight. At the time of the experiment which was tried upon himself he was feeling somewhat depressed—had the blues, in other words—owing to the absence of his family and the loneliness of his house without them. After dinner he smoked a couple of the cigars, with the effect that the “blues” were expelled and he felt the exhilarating effect of the drug in the same manner as after a dose of the wine. It is his opinion that the effect of the cigars is milder than that of the wine, but he is satisfied that he experienced the peculiar power of the coca by smoking it. He will continue his experiments in other cases.

Mr. S., of the same city, who was suffering from dyspepsia and its attending depression, smoked the cigars after meals at my suggestion, the result being to dispel the depressed feeling and remove the fullness experienced after eating a meal. Repeated experiments confirm this. As coca is said to stimulate the gastric nerves and greatly facilitate digestion, the above experience seems to prove that the cigar has a similar effect.

Mr. C., a clerk in a cigar-manufactory, Philadelphia, smoked several of the cigars. He says that the first one was used during the hot weather of summer, when he was nervous and depressed by the heat. The effect was to stimulate him, remove the depression, and steady his nerves, and he felt well afterwards for the rest of the day. Repeated experiment confirms him in the belief as to the correctness of his view that coca-leaf smoked is a stimulant and tonic. He inhaled the smoke.

Dr. K., Philadelphia, has smoked a number of the cigars at my request. He is familiar with the effect of coca, having used it while a student as a stimulant during his researches on the heart at the physiological laboratory of the Jefferson Medical College. He recognizes the stimulating effect of the drug in the cigar.

Mr. M., Philadelphia, a chemist of much reputation and a very careful observer, finds a stimulating effect from the cigar the same as his experience in the use of coca. He will continue to experiment with it.

Prof. S., for many years a teacher of pharmacy in Philadelphia, a gentleman of ex-

cellent powers of observation, says that he experiences the peculiar effect of coca on smoking the cigar.

Chief Engineer N., U. S. N., a member of a recent Arctic exploring expedition, says that he did not experience any exhilaration from the smoke of the coca-leaf. He, will however, continue his experiments still further, and report to me after doing so.

Personally, I have found the effect of smoking coca-leaves to bear out the statement that the drug produces a general excitation of the circulatory and nervous systems. Smoking and inhaling the smoke of one or two cigars will increase my own pulse-rate some eight or ten beats to the minute. It certainly relieves the sense of fatigue. Smoked at night, in my own case and in the cases of several of my patients, it produces wakefulness similar to strong coffee.

The exaltation produced by it does not seem to be followed by any feeling of languor or depression. I find it a relief after a full meal, like a good tobacco cigar. It seems to impart increased vigor to the muscular system as well as to the intellect, with an indescribable feeling of satisfaction. I have never experienced any intoxicating effect from smoking it. Dr. Bartholow says that coca, as is the case with tea and coffee, acts as an indirect nutrient by checking waste, and hence a less amount of food is found necessary to maintain the bodily functions; and it is probable that some of the constituents of coca are utilized in the economy as food, and that the retardation of tissue-waste is not the sole reason why work may be done by the same person better with than without it: and I have just learned, in a letter from Messrs. Parke, Davis & Co., that "a Mr. Stevens, a citizen of Abilene, Kansas, who was afflicted with hay-fever, and was about to go to the mountains, had concluded to remain at home, having obtained relief from the use of cigarettes of coca. Every morning he uses a cigarette, and finds perfect relief. He uses three per day, and also has used an application of a two-per-cent. solution of muriate, but finds that the cigarettes relieve him quicker and the effects last longer."

To sum up, therefore, coca smoked seems to produce the same effect on the system as coca taken internally in the form of fluid extract, wine, or elixir, but not in such a marked degree. Coca itself is known to be stimulant, tonic, and restorative to the system in the treatment of various diseases marked by debility and exhaustion. Nervous debility and exhaustion in all its forms, whether caused by disease or excesses, are said to be relieved by it. Fatigue disappears, to be followed by a feeling of indescribable calm and satisfaction, increased strength of brain and muscle, and desire for mental and muscular occupation.

Coca has been used with great success in the treatment of the opium habit. It is also an excellent substitute for tobacco. It has been successfully used in dyspepsia, flatulency, colic, gastralgia, enteralgia, hysteria, hypochondria, spinal irritation, idiopathic convulsions, nervous erethism, and in the debility following severe acute affections. As it is a valuable restorative agent, checking tissue-waste, it is a useful remedy in consumption and wasting diseases generally. It is also of value in the nervous forms of sick-headache, *migraine*. It is said to be an aphrodisiac.

Now, my object in publishing this article is to introduce coca-leaf cigars to the profession. I have furnished what information I have to prove the cigars are capable of producing the action of the drug. In my own mind I have no doubts on the subject, though the effects are milder than those resulting from the employment of the fluid preparations of coca internally. I have also summed up the properties said to be possessed by coca as a therapeutic agent. I have produced evidence, in addition to that furnished by Dr. Lewis, that it is of value in the treatment of hay-fever; and, as it is important that the true value of this form of using coca-leaf should be known, I have had some made, and I will send samples to members of the profession, free of charge, who may desire to test them, and will publish the results, favorable or otherwise, in the medical press. I have no proprie-

tary interest in them, nor have I copyrighted this article concerning them. The idea of coca in this form, and all information concerning it, is free to the use of the profession.

COCAINE FORMULÆ.

The formulæ for using Cocaine must of course be varied to meet the requirements of the individual case. We, however, present a few combinations which have been used with advantage:

TO ALLAY IRRITATION IN CHRONIC PHARYNGITIS.

- ℞ Cocaine hydrochlorate..... gr. jss.
 Glycerine..... ʒ ss.
 Distilled water..... ʒ j.
 Carbolic acid..... gr. i-8.
 Sig. Paint over affected parts night and morning.

AS A LOCAL ANÆSTHETIC.

- ℞ Cocaine hydrochlorate Crystals..... gr. 2¼.
 Distilled water..... ʒ j.
 M. Sig. Apply with camel's-hair pencil.

If the solution is to be kept any length of time use instead of pure water a solution in distilled water, seven grains to the pint, of thymol or of salicylic acid. In a similar manner four-per-cent. solutions may be made of the other salts of the alkaloid.

TOOTHACHE.

- ℞ Cocaine muriate crystals..... gr. x.
 Glycerite of tragacanth, q. s.
 Make a mass and insert a minute portion into the cavity of the sensitive tooth.

NEURALGIA.

- ℞ Menthol..... gr. xxx.
 Cocaine hydrochlorate crystals..... gr. vj.
 Alcohol, q. s., ad..... ʒ i.
 Chloroform or bromide of ethyl may be advantageously substituted in this formula for alcohol.
 M. Sig. For external application.

Another valuable formula for the relief of neuralgia is the following, viz:

- ℞ Oil of cloves..... ʒ j.
 Cocaine muriate crystals..... gr. xv.
 M. Sig. For external application.

OLEATE OF COCAINE.

- ℞ Cocaine alkaloid..... gr. 2½.
 Oleic acid, pure..... ℥ xx.
 Almond oil..... ℥ xl.
 Dissolve the alkaloid in the oleic acid and add the almond oil.

A weak solution of cocaine may also be used with advantage hypodermically in counteracting the effects of the alcohol and opium habits.

A COMBINATION OF COCAINE FOR INSUFFLATION.

Schnitzler ("Ctrlbl. f. d. ges. Therap.") suggests the following:

- ℞ Hydrochlorate of cocaine..... 4 to 8 grains.
 Hydrochlorate of morphine..... 3 grains.
 Subnitrate of bismuth, } each..... 75 grains.
 White sugar, }

Or the vapor of the following solution may be inhaled.

R Hydrochlorate of cocaine	8 to 16 grains.
Chlorate of potassium.....	150 grains.
Cherry laurel water ..	5 drachms.
Water	16 ounces.

COCAINE IN THE VOMITING OF PREGNANCY.

R Hydrochlorate of cocaine.....	5 grains.
Alcohol, enough to dissolve the cocaine.	
Water.....	10 ounces.

A teaspoonful to be taken every half hour

COCAINE MIXTURE FOR RELIEF OF COUGH AND VOMITING IN CHRONIC PHARYNGITIS.

Jahn, in the *Gazette Médicale de Paris*, of March 14, 1885, recommends the following formula for the relief of the cough and vomiting of chronic pharyngitis:

R Cocaine.....	gr. iss.
Glycerine.....	f 3 iv.
Aquæ dest.....	3 ij.
Acidi carbol.....	gr. i-6.

M. Sig. Apply morning and evening with a suitable brush.

COCAINE FOR FILLING TEETH.

R Cocaine pur.....	gr. vi.
Iodoform	gr. x.
Gum mastic	gr. iij.
Ol. eucalyp. vel eucalyptine	gr. viij.
Chloroform.....	3 ij.

M. Sig. Dissolve the cocaine and iodoform in half the prescribed quantity of chloroform, and the other ingredients in the remainder, then mix the two solutions. If required for "painting" around a tooth, on the gums, or elsewhere, but not for "stopping" purposes, the mastic should be omitted altogether; while, on the other hand, the quantity may be increased if a tenacious semi-fluid substance (rendered mobile by warming) for direct application to a hollow stump be needed. This preparation should be kept in tightly corked tubes or bottles.

HYPODERMIC USE OF COCAINE.

The hypodermic use of cocaine has been ably discussed by J. M. DaCosta, M. D., in the following paper, entitled "Some Observations on the Use of the Hydrochlorate of Cocaine, Especially its Hypodermic Use," read before the College of Physicians of Philadelphia, and published in the *Medical News*, Dec. 13, 1884:

Hydrochlorate of cocaine is a drug evidently of such power that, on reading the effects produced on the eye, I determined to investigate its properties in other respects, with a view of ascertaining whether it might be of use to the physician as well as to the ophthalmologist. I shall first detail some conclusions I have arrived at with reference to its *local* action.

On the *throat* it undoubtedly diminishes the sensibility, and is serviceable in causing the laryngoscope to be better borne. Moreover, it is of use in irritable relaxed throats, and in instances in which there is spasmodic difficulty in swallowing associated with this irritability, or from other causes. In ulcers at the back of the throat, connected with dysphagia, painting the parts two or three times daily affords considerable relief. Only, for this to last, the solutions employed must be stronger than those which have been used—not from two to four, but from eight to twelve per cent. In tubercular laryngitis the action is excellent. Even a four per cent. solution gives hours of relief, in some cases as many as six hours freedom from the sense of irritation and the difficulty of swallowing; and stronger solutions

relieve for a longer time. The result obtained is far more certain and decided than from the local use of morphia. Compared with iodoform, it is probably less permanent, but as good, or better, at the time.

Dr. Jurist, whom I asked to employ the hydrochlorate of cocaine at the throat clinic of the Jefferson Medical College, has favored me with a note in which he speaks of the remedy being "brilliantly successful" in relieving pain and making deglutition easy in painful diseases of the pharynx and larynx, preëminently in tuberculosis and in syphilis.

Using chromic acid and the galvanic-cautery frequently, he found that, by first painting the parts with a four per cent. solution, the employment of these agents could be made comparatively painless, and that the efficacy of these, or, indeed, of all caustic and destructive means, is not interfered with.

In syphilitic ulcerations especially this was tested, and much suffering prevented. Where only four per cent. solutions are employed, the patient may not feel the caustic application to the abraded surface for about twenty or thirty minutes, but after this it becomes painful. All trials should be preceded by careful cleansing of the parts. The local action of the cocaine is also astringent and hemostatic, as well as one destroying sensibility. This local action may also be perceived on the tongue and gums. "Although facilitating intralaryngeal medication, it does not prevent spasms," Dr. Jurist writes me, "and consequently is valuable in intralaryngeal operations only on account of its anæsthetic effects."

As regards the local use of cocaine on other portions of the human body I am able to record some observations made in my ward at the Philadelphia Hospital. In one instance, pain in a hollow molar tooth was speedily relieved by inserting a piece of cotton saturated with a four per cent. solution. It may, in passing, be remarked that cocaine used hypodermically in the same patient failed to mitigate an attack of intestinal pain of colicky kind which had lasted for two days. A case of earache which seemed to be neuralgia was at once relieved by instilling a few drops of a four per cent. solution into the meatus; and a similar observation was made by the resident physician in the ward of my colleague, Dr. Hutchinson. As regards facial neuralgias, the results were less decisive than anticipated. Perhaps they would become more so if we were to rub in an oleate of cocaine over the aching nerves, or larger nerve trunks, or to use a hypodermic for its local use where the disordered nerves are superficial and easily reached. In one instance of neuralgia of the face, in which the pain shot into the jaws, painting the gums of the upper jaw with a four per cent. solution gave very speedy relief. For the amelioration of painful and irritable affections of the nasal mucous membrane, hydrochlorate of cocaine, in not less than a four per cent. solution, is of use; and I have known applications with caustics made without pain when the membrane, after being well cleansed, had been painted with the solution. Since becoming acquainted with the action of the remedy, I have had no case of rose cold or hay fever; but it ought to be of service, and I would suggest its employ in these most troublesome affections.

While discussing its local use, it may not be inappropriate to refer to the fact that the solutions of the hydrochlorate of cocaine we all employ—Merck's hydrochlorate—contain less of the alkaloid than supposed; a four per cent. solution, for instance, is only of about three per cent. strength. My attention was called to this by Dr. Jurist, whose remarks, speaking of his observations, I append; and while writing these lines I find that Dr. Squibb has just published the same conclusion:

"The difficulty experienced in obtaining the cocaine hydrochlorate in bulk, while the solutions were always at command, made it seem desirable to study the latter more closely. In conjunction with my friend, Mr. Stedem, a number of examinations were made. Our later investigations included Merck's manufacture in bulk.

"Experiment I.—On adding a dilute solution of ammonia to a solution of the cocaine salt, and then agitating with chloroform, the ammonium hydrochlorate could readily be

drawn off with a pipette, leaving the cocaine in solution in the chloroform. By carefully evaporating both solutions, the ammonium salt was readily obtained in pure crystalline form. On the watch-crystal into which the chloroform solution was poured, there were formed a number of *white acicular crystals surrounded by an aureola of sticky, resinous material*, light-yellow in color, and altogether amorphous in character. The crystals were soluble in hot and cold water; the resinous product in dilute *hydrochloric acid*, but not in water.

"Experiment II.—Another portion of the solution was carefully evaporated over a water-bath. The resulting mass was similar in appearance to the first, but was readily soluble in water. The difference in solubility is accounted for by the acid state of the residue. When it is remembered that cocaine and its salts have heretofore been described as colorless and crystallizable, and that Merck's product is amorphous granular, and of a light straw color, and further, that chemical manipulations separate a resinous mass from the commercial article, the proposition that our present solutions do not contain the full proportion of the active principle, appears to be well grounded."

But what has interested me much about the drug, and what, so far as I know, has not been as yet investigated, is its hypodermic employ, elucidating its general action. In the observations I am about to detail, I have been greatly aided by Dr. Ecroyd, the resident physician in my ward at the Pennsylvania Hospital, and by Dr. Woodbury. We have tried the remedy both on the well and the sick, especially in cases of neuralgia and other painful affections, and have arrived at certain definite conclusions. But first let me speak of the dose. We began with one minim of a two, then of a four per cent. solution, only to find them inert. No influence could be detected on pulse, respiration or temperature; nor was any local anæsthesia produced at the point of injection. Indeed, no decided effects are produced with less than eight minims of a four per cent. solution, or one-third of a grain of the hydrochlorate of cocaine; and half a grain will show these effects even more strikingly. In some instances two thirds of a grain were used.

As regards the local influence at the point of injection, there is considerable difference whether a superficial or a deep hypodermic be used. A hypodermic thrown into the superficial layers occasions local anæsthesia, so that the part may be pricked with needles without these being felt. In one case in which we tried one of these superficial injections in a boy of nineteen, a wheal was produced which was quite insensitive, while all around it sensation was preserved, though perhaps slightly reduced. It is evident, therefore, that if it be desirable to use the hypodermic means of producing local insensibility for the removal of small tumors and the like, a superficial injection immediately into or very close to the parts to be removed will have to be practiced. These superficial injections do not occasion subsequent inflammation or abscesses. This is equally true of deeper injection into the tissue below the skin in the manner in which hypodermics are generally given. But the deeper injections do not produce local anæsthesia of the surface.

Now, as regards the *general* effect of hydrochlorate of cocaine hypodermically employed, it has a little, but not very much, influence on *sensation*. Most patients speak of a sense of warmth all over the body, which, beginning at the point of injection, becomes general in from five to ten minutes; it is, however, not of long duration, the arm in which the injection was practiced feeling numb or heavy, or, as one expressed it, "funny." In him, half a grain having been thrown into the left forearm, the sensibility of the skin was diminished from the elbow down to the fingers on that side, and two sharp points were not as distinctly as previously distinguished at the tips of the fingers. There was no change of general sensibility in the legs. The mucous membrane of the lips, tongue, and fauces, was slightly less sensitive to sharp points; the conjunctiva was less sensitive, the pupils were dilated.

On the whole, then, there is some general reduction of sensibility, though it is not

marked, and is transitory. And this observation accords with others in which one-third of a grain was used, where the alteration of sensibility showed even less; and with a few in which two-thirds of a grain were employed. The general sensibility is therefore only slightly altered.

On the *temperature*, the effect is to heighten it somewhat. This is the record taken by Dr. Ecroyd in the case of a well-nourished man suffering from pains in back and gluteal region, seemingly due to muscular rheumatism:

One-third of a grain of hydrochlorate of cocaine was used; no local anæsthesia was produced at the point of injection, and there was no influence on the pain.

At 11 A. M. (just before injection), pulse 76; resp. 17; temp. 97.5°.

At 11.25 A. M. (after injection), pulse 70; resp. 16; temp. 98.5°.

At 11.40 A. M. (after injection), pulse 66; resp. 16; temp. 98.5°.

At 11.55 A. M. (after injection), pulse 64; resp. 97; temp. 98.4°.

At 12.10 P. M. (after injection), pulse 68; resp. 16; temp. 99°.

Similar observations were made in other cases; and it may, in general terms, be stated that the temperature rises from half a degree to a degree and a half; that it does not do so abruptly; but that the rise is maintained for several hours. Within ten minutes after the injection has been given, an increased heat is registered. In one case it was four-tenths of a degree above the figure of starting, and it never reached more than half a degree, which it did one hour and five minutes after the hypodermic injection of one-third of a grain.

The most striking effect of the hypodermic injection of cocaine is on the *circulation*. The pulse may be somewhat accelerated or slower; but it always becomes fuller and stronger. The frequency of beat was noted to fall from 66 to 54, twenty minutes after the injection. In other instances there was but little variation; in a few a slight quickening was detected. But not in a single instance was there not a fuller and a stronger pulse. We made many observations on these points at intervals of fifteen minutes, the sphygmograph being kept in place to insure uniformity of pressure, and always with the same result.

On the *pupils* the influence is very marked. They become speedily dilated; and with the change, uncertainty of vision is complained of. The dilation of the pupils, following the hypodermic injection, does not last more than a couple of hours, and during this period ophthalmoscopic examination is of course very easy.

On the *secretions*, I have not as yet fully studied the drug. On the bowels it had no influence; the urine appeared increased in quantity, and the specific gravity decidedly lowered, while the phosphates were found to be increased. But our observations were not very numerous or definite on these points.

Summing up now some of the general effects observed, the drug, used hypodermically in the doses mentioned, failed to relieve attacks of intestinal pain, and was useless in cases of obstinate neuralgias, especially in sciatica. This was especially shown in a case at the Pennsylvania Hospital, in which about ten hypodermic injections were given, varying between one-third and a half grain, but in which no decided effect on the pain or the disease was produced. It is, however, fair to state that the case was of a year's standing, and had resisted blisters and chloroform injections. The cocaine influenced somewhat the dull pain; but did no permanent good. Neither in this case nor in others did it induce sleep. In certain very superficial neuralgias, its local action, not its constitutional influence, does temporary good. As an anæsthetic, its local action is the one which will give it its great value; and in diseases of the eye, ear, throat, tongue, and nose, the insensibility to which it gives rise suggests a wide range of application. But this insensibility cannot be produced to a sufficient degree through the constitutional effect of a hypodermic.

Yet thus resorted to, the remedy has other and valuable uses. The effects on the pulse and temperature recorded in these observations, suggest its application in many a con-

dition of collapse, of weak heart, or heart failure; and its employ in low fevers, too, as a cardiac stimulant is a self-evident proposition. How permanent the benefit, how often the doses must be repeated, are matters which experience alone can determine.

The following article by A. B. Lyons, M. D., which appeared in the *American Journal of Pharmacy*, October, 1885, will furnish the reader an array of interesting facts relating to the alkaloids of cocaine which have been nowhere else so thoroughly presented:

NOTES ON THE ALKALOIDS OF COCA LEAVES.

A year ago there was probably not a dozen places in the United States where cocaine could have been bought, and, except in an experimental way, not a grain of the alkaloid had been manufactured in this country. To-day there is not a second-rate drug store in any one of our cities which does not keep on hand a small supply of the article, and manufacturers have been obliged again and again to increase their capacity to produce it, so active has been the demand.

As long as the alkaloid was only to be found in collections of rare chemicals, or as an item in the long list of articles which for the sake of completeness the largest dealers in chemical specialties were obliged to have in stock, no especial interest was attached to this particular alkaloid, and accordingly we find most of the text-books entirely silent with regard to its properties; many of them do not even mention its existence.

Now that it has come into every day use, however, it is important that its chemical reactions should be as well known as those of quinine or caffeine, since it is now liable to come under observation in medico-legal investigations. It is also desirable that the physical properties of the cocaine salts should be familiar, so that purchasers may be on their guard against substitutions or adulterations.

There is yet much to learn in regard to the alkaloids of coca leaves. It is not improbable that there may be several distinct alkaloids which have not yet been described. It is very certain that much of the cocaine in the market is a mixture of several apparently distinct substances, but cocaine is itself so unstable a compound that it is not easy in the present state of our knowledge to affirm that some of these substances are not allotropic modifications of cocaine itself.

Coca leaves when they reach this country contain, so far as assays have yet been able to show, not more than 0.8 per cent. of cocaine. The writer has examined leaves which yielded no more than 0.15 per cent., and of this scarcely any was capable of forming crystallizable salts. Freshly imported leaves of a recent crop contain generally 0.65 to 0.8 per cent. of extractable alkaloid, but of this not more than one-half generally consists of crystallizable alkaloid. In manufacturing operations the yield of alkaloid is much below what assays show to be present. It is doubtful indeed whether any method of assay yet devised extracts nearly all the alkaloid. A good sample of coca leaves yields a tincture which when titrated with Mayer's reagent gives an apparent alkaloidal strength much higher than the assay indicates, but it is altogether possible that the precipitate consists in part of compounds not alkaloidal.

The assay process adopted by the writer has been recently described in detail;*

* Chicago Pharmacist, September, 1885.

it consists in treating the leaves, in fine powder, with about eight times their weight of a mixture of strong ether 95 volumes, spirit of ammonia five volumes, and washing out the alkaloid after 24 hours' maceration from an aliquot portion of the solution, first into acidulated water, then from alkaline solution into ether, evaporating and weighing. Some assays have been reported from Bolivia which seem to show that the leaves when freshly gathered contain a much larger proportion of alkaloid than after transportation to this country. This confirms the statement that has been often made, that in Peru and Bolivia coca leaves are believed to deteriorate very rapidly, so that when more than six months old they are not considered fit for use. It is even stated that the coca chewers find that the leaves when they arrive at the coast, in the usual mode of transportation, are less active than at the beginning of their journey. In a climate as damp as that of the coca-producing regions it is probably next to impossible to dry the leaves properly before packing, and it is easy to understand how under these conditions they suffer from so short a journey.

Some packages of coca shipped from Lima apparently in good condition, at the end of their voyage were found by the writer much heated—temperature in the centre of the package 110° F.—and evidently greatly deteriorated. These leaves contain nearly 18 per cent. of moisture; had they been really dry, *i. e.*, so as to contain 10 per cent. or less of moisture, they would probably have lost nothing in the transportation.

The alkaloid obtained from leaves that have deteriorated is always more or less dark colored, and contains a small portion only that is capable of taking on the crystalline form. From good leaves the alkaloid obtained in assays is nearly or quite colorless, and is left in the form of a crystalline mass on evaporation at a low temperature of the ether.

Crude cocaine has a characteristic tobacco-like odor, which suggests the idea that some portions of the product have become split up so as to reveal the pyridine constituent of the base. This odor, however, does not disappear when the alkaloid is neutralized. Solutions of the crude product in alcohol have generally a brownish color, which is deep in proportion to the amount of impurity present. From hot alcoholic solutions, 1:1, a large portion of the alkaloid separates on cooling in the form of distinct prismatic crystals. The mother-liquor by spontaneous evaporation yields another crop of less perfect crystals, which may, however, be obtained by repeated recrystallization nearly or quite colorless. After the cocaine has all crystallized out there remains a dark-colored syrupy liquid, which consists partly of alkaloid apparently identical in chemical and physiological characters with cocaine, but which does not itself crystallize, and does not form crystallizable salts. For this uncrystallizable alkaloid the names cocaicine and cocainidine have been proposed. It appears to bear to cocaine a relation similar to that of chinoidin to quinine, or of invert sugar to sucrose, but no ultimate analysis has as yet been made of it, and our knowledge of it is very incomplete.

Besides this there is often present a feebly basic, extremely bitter substance, which possibly may be ecgonine, of which accounts accessible to me are very meagre. The malodorous constituent already mentioned seems not to have the character of an alkaloid, for its odor remains unchanged after neutralization with an acid. It is easily separated from the crystallizable alkaloid by repeated crystallizations, and this appears to be the only way of obtaining a pure product.

Pure cocaine should exhibit the following characters: colorless distinct crystals (Fig. 1), or a crystalline white powder, without odor, at first seeming to be tasteless, but as it dissolves developing a slightly bitter taste, and producing numbness of the tongue; wholly soluble in ether, soluble also in alcohol, chloroform, benzol, petroleum ether, bisulphide of carbon, in "petrolina" oil and melted petrolatum, and in fixed and volatile oils;

nearly insoluble in water.* It combines with acids, completely neutralizing them and forming salts which are generally easily crystallizable.

The salt of cocaine most employed is the hydrochlorate. Although crystallizing easily, it is often offered in the form of an amorphous powder, and such a product is not of necessity impure. The salt, however, should be nearly white, and wholly free from odor, and should show no disposition to absorb moisture from the air. The microscopic appearance of the crystallized pure salt is shown in Fig. 3, B, drawn from nature. It should dissolve easily and completely in water, yielding a colorless solution, neutral or very faintly acid to litmus paper, and having a saline, not a strongly bitter taste. A solution containing one grain to the fluidounce will produce a sensation of numbness in the mouth and throat if a few drops of it are swallowed. When treated with Frøehde's reagent (sulphomolybdic acid) the salt should produce no immediate coloration; impure

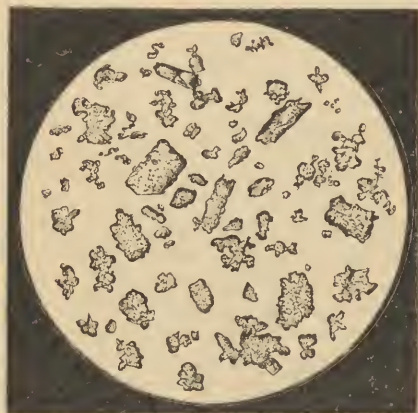


FIG. 1.—Cocaine alkaloid, commercial product crystallized from alcohol. X 50 diameters.



FIG. 2.—Cocaine muriate. Crystals obtained by spontaneous evaporation of a drop of saturated aqueous solution. X 100 diameters.

products generally give a reddish brown color, more or less rapidly fading. In a few cases a green color has been observed to develop subsequently.

The salt dissolves in less than its own weight of water. It is also freely soluble in alcohol, less readily in absolute alcohol and in chloroform, and is particularly insoluble in ether, in petroleum ether and in fixed and volatile oils. The aqueous solutions yield by spontaneous evaporation acicular crystals, which after drying over sulphuric acid seem to be anhydrous. Crystals obtained from alcoholic solutions are certainly anhydrous. Their form is that of rhombic plates, but the crystals are generally very imperfectly formed. (Fig. 2.)

Cocaine hydrobromate is a salt less employed than the hydrochlorate, but deserving to be better known. It crystallizes readily from aqueous solutions in slender transparent prisms (Fig. 4), which are permanent in the air. They contain two molecules (8.57 per cent.) of water of crystallization. The purity of the salt is at once manifest in its crystalline appearance, and there is no reason why it should not always be offered

* Authorities state that cocaine requires for solution 704 parts of water. The crystallized alkaloid is much less soluble than this, since it crystallizes from a solution containing 1:1,500. It would probably require of cold water for solution not less than 2,000 times its weight.

in the form of distinct crystals. It contains of course a smaller proportion of cocaine than the muriate (72.2 per cent. in the former, 89.25 per cent. in the latter), so that to produce the same effect a larger quantity will be required.

Cocaine citrate has been employed to a limited extent in dentistry, but has no points of superiority over the muriate. It does not easily assume the crystalline form, and owing to its hygroscopic nature it is very troublesome to dispense. It can be formed into pellets for dentists' use without the addition of any excipient; but by the use of a small amount of excipient the hydrochlorate can be made easily to answer the same purpose.

Cocaine combines with oleic acid to form a readily crystallizable salt, which is much employed in the form of a solution in excess of oleic acid or in any bland oil. Where an oil is used it will be found necessary to employ in connection with it a certain proportion of oleic acid, or crystals of the cocaine oleate will separate from the solution in cold weather.

A more desirable preparation, perhaps, is a solution in a pure mineral oil¹ of the alkaloid itself, and although there still exists a prejudice in the minds of some physicians against the use of mineral oils in liniments, ointments, etc., experience seems to show



FIG. 3 A.—Cocaine alkaloid, crystals formed by adding ammonia to aqueous solution, 1:100, of cocaine muriate. X diameters.

B. Cocaine muriate crystals, commercial. X 50 diameters.



FIG. 4.—Cocaine hydrobromate. Crystals formed by spontaneous evaporation of aqueous solution. X 50 diameters.

that this preparation at least is as active as a solution of the oleate of the same strength in oleic acid or in a vegetable oil.

Cocaine combines with boric acid to form a crystallizable salt rather sparingly soluble in water, which contains no more than 55 per cent. of the alkaloid, one molecule of base requiring apparently four of boric acid for neutralization.

There seems to be no reason why this salt should be used in preference to the hydrochlorate or hydrobromate, and in fact it is little employed.

While sulphuric acid cocaine forms a salt which crystallizes easily in short six-sided prisms; of the remaining salts the oxalate may be mentioned as one which crystallizes easily, and which may be obtained from an ethereal solution of the alkaloid by the addition of an ethereal solution of oxalic acid.

The behavior of the salts of cocaine to reagents presents little that is distinctive.

So far as my experiments have extended, it does not give any color reactions of any importance. Its most characteristic peculiarity is the facility with which its molecule is split up, with formation of benzoic acid. If treated with an alcoholic solution of sodium or potassium hydrate, the alkaloid is very rapidly destroyed, and benzoic ether, recognized by its odor, is immediately formed. After a short time the solution is found to contain abundance of benzoic acid, but hardly a trace of alkaloid. If ecgonine is formed in the first stage of the reaction it must be afterwards in turn destroyed, or else its reactions are not those of an ordinary alkaloid. Lime and ammonia act more slowly, but both gradually effect a similar result. This action of alkalies was recently pointed out by H. MacLagan (*American Druggist*, February, 1885). It had previously been well known that cocaine is split by the action of strong hydrochloric acid into benzoic acid, ecgonine and methylic alcohol by a reaction which Lössen formulates thus:



G. Calmels and E. Gussin have recently showed that baryta effects the same decomposition when heated for some time at 120° C. in a sealed tube with a solution of cocaine hydrochlorate. According to these authorities, ecgonine has the characters rather of an acid than an alkaloid. It is neutral in reaction and combines with alkalies to form compounds which have a faintly alkaline reaction and are very soluble in water and alcohol. It forms, however, double salts with platinum and gold chlorides, but, unlike those of most alkaloids, these are readily soluble in water. By destructive distillation of the barium compound of ecgonine these authors obtained an isotropine, $\text{C}_8\text{H}_{15}\text{NO}$, which they regard as methoxyethyltetrahydropyridyne, ecgonine being methoxyethyltetrahydropyridine-carboxylic acid, while cocaine is methylbenzo-methoxyethyl-tetrahydropyridine-carboxylate, an extremely plausible and lucid view, no doubt, but one which we must be content to leave to the theorists to discuss.

For the identification of cocaine the organoleptic properties of the alkaloid are of the first importance. The numbing effect upon the tongue is unlike that of any other substance. The effect on the mucous membrane of the eye is equally striking. One drop of a four-per-cent. solution will blanch the entire conjunctiva, an effect which is most strikingly manifested on the vascular inner surface of the lids. The anæsthetic effect is also very noticeable, even from this small quantity of the agent, and may be fully developed by repeating the application two or three times at intervals of two minutes. More or less dilatation of the pupil generally follows such an application, but does not appear to be a constant effect. It is questioned by some, indeed, whether cocaine itself dilates the pupil at all, this effect being attributed to hygrine, or some other accompanying alkaloid. I am inclined to think the effect is really produced by cocaine; at least I have not succeeded in producing a salt which does not exhibit this action. It is certainly safe to say that it is not due to contamination with hygrine, which could not be present in the purified product.

Reactions of the various impurities liable to occur in cocaine have not as yet been sufficiently studied. One curious one I may mention, although the explanation of it is not yet found. This is the development of an intense green color by the action of acids. When the impure alkaloid is treated with hydrochloric acid to produce a salt the solution assumes this color as long as the acid remains in excess. As the solution becomes neutral the green color fades, passing finally to a brownish shade, with separation of a flocculent brown precipitate. The color suggests the idea that there may be present some chlorophyll derivative. Other acids besides the hydrochloric develop it under similar circumstances.

The behavior of solutions of pure cocaine muriate with the common reagents has been studied by the writer with the following results:

Mayer's reagent is capable of detecting very minute quantities of the alkaloid. A single drop of a solution containing one part of the salt in 12,500 parts of water yields with this reagent a distinct precipitate. A faint cloud is produced in a solution, 1:100,000; in one of half this strength it is barely discernible, a single drop of the solution being placed on a mirror being employed in this as in the other tests mentioned.

In solutions containing one part of alkaloid in 500, one Cc. of Mayer's reagent corresponds with ten milligrams of alkaloid; in solutions of double this strength, one Cc. of reagent consumed indicates 12.5 milligrams of alkaloid, while in solutions twice as strong again (1:125) one Cc. of the reagent indicates 15 milligrams of cocaine. In estimating the strength of a solution volumetrically, therefore, by this reagent, it is necessary to obtain in a preliminary experiment a rough approximation to the result, and then, having diluted the solution so that it shall contain nearly one part of alkaloid in 500, to make a second, more careful experiment; but this is true, to a greater or less degree, of all titrations with Mayer's reagent.

A solution of iodine in iodide of potassium produces in a solution containing 1:7,500 of cocaine hydrochlorate a pinkish precipitate; in stronger solutions the precipitate appears brown. A faint yellowish cloud is produced in solution 1:200,000; barely perceptible in a solution 1:400,000.

Phosphomolybdic acid produces a faint turbidity in a solution 1:50,000, and a distinct precipitate in one 1:12,500.

Tannin produces a faint cloud in solutions 1:25,000 (neutral); a distinct precipitate in solutions 1:12,500.

Picric acid produces in strong solutions a yellow precipitate, which assumes crystalline form. In solutions 1:400 the precipitate is thrown down at once, appearing under the microscope in sheaf-like forms. In solutions 1:1,000 a few crystals may be found, appearing after the lapse of some minutes.

Potassium bichromate precipitates only strong solutions (1:25), the precipitate being amorphous or yellow.

Mercuric chloride produces a white amorphous precipitate in solutions 1:100, none in solutions of half that strength.

Caustic alkalies precipitate the alkaloid in crystalline form from moderately dilute solutions; from stronger ones in amorphous state, but soon assuming crystalline form. Thus, in a solution 1:500 ammonia produces at once a white precipitate, which soon changes to stellate groups of crystals. In a solution 1:1,000 the crystals appear in a few minutes, in a solution 1:1,500 the crystals develop only after some time.

Caustic soda and potash produce very similar effects, the crystals perhaps forming more promptly. Where ammonia is the precipitant the crystals often arrange themselves in complicated growths, tufts of acicular crystals springing from the nodes of jointed stems formed by the larger primary crystals. (See Fig. 3, A.)

The carbonates and bicarbonates of the alkalies produce in solutions of the same strength precipitates of cocaine alkaloid, which are at first amorphous, but which gradually take crystalline form, becoming ultimately identical in appearance with the crystals produced by caustic alkalies.

Platinum chloride produces at once in solutions 1:400 a yellow precipitate, consisting of plumose crystals, most of stellate pattern, bearing thus a general resemblance to snow-flakes. (See Fig. 5.) In solutions 1:800 the crystals are more simple in form, consisting generally of one main crystal, with two or three parallel branches joined at an oblique angle, and these more or less subdivided. In solutions 1:1,600 most of the crystals resemble carpet tacks, consisting of a short, well-formed prism, with a single branch from the centre, joined at an oblique angle and tapered to a point.

A few crystals, similar to those just described, form after some time in solutions 1:3,000.

Chloride of gold produces characteristic crystalline precipitates, assuming peculiarly beautiful forms. In solutions containing one in 3,000 an immediate precipitate is pro-



FIG. 5.—Precipitate formed by platinum chloride in solution, 1:500, of cocaine hydrochlorate. X 100 diameters.



FIG. 6.—Precipitate formed by auric chloride in solution, 1:3000, of cocaine hydrochlorate. X 75 diameters.

duced, assuming forms resembling those of fern-fronds (Fig. 6), generally with a stellate arrangement.

In solution 1:12,500 crystals form after some minutes, showing the same fern-frond patterns, but not generally the stellate arrangement.

A solution was prepared of the amorphous cocaine (cocainoidine) in the form of a hydrochlorate, and a similar series of experiments carried out with this, the general conclusion drawn from which was that the compounds of this alkaloid are very averse to assuming the crystalline form. The precipitates produced by alkalis did not crystallize at all, neither that by picric acid. In very dilute solutions (1:5,000) the chloride of gold produced after some time minute prismatic crystals, wholly unlike in general appearance the compound fern-like crystals obtained when the crystallizable salt was employed. Similarly, in the more dilute solutions (1:1,000) chloride of platinum produced a few rosette-like crystalline aggregations, contrasting strongly in appearance with the feathery forms obtained from the crystallizable salt. The limit of sensitiveness with different reagents was also in some cases strikingly different, although we must remember that the solution of the amorphous product is itself probably complex in character.

With alkalis the limit was found to be at a dilution of about 1:1000, with platinum chloride 1:1,200, with gold chloride 1:9,000, with picric acid 1:5,000 (that of the crystallizable salt being only 1:1,000), with Mayer's reagent 1:18,000 (that of the crystallizable salt being 1:200,000).

Solutions prepared from the amorphous alkaloid, if evaporated even at a very gentle heat, have invariably turned dark, and if the salt is evaporated quite to dryness it is found to be then imperfectly soluble in water. A solution of the crystallizable salt can be evaporated even at 100° C. without changing color, and the residue is perfectly soluble. It is probable, however, that the body which suffers decomposition in evapora-

tion is a distinct alkaloid or a non-alkaloidal substance, for solutions which have been treated with animal charcoal, or by some other plans for purification, while they still contain amorphous alkaloid in abundance, do not exhibit this behavior.

One peculiarity of even the purest cocaine salts is their disposition to give up their acid, probably the result of the instability of the base. Steel spatulas, etc., exposed to the air in contact with the dry hydrochlorate soon become rusted, but the same thing is often observed in regard to the salts of ammonia and other volatile bases.

The important points which I wish to emphasize are: 1. That the alkaloid obtained from coca leaves consists of a mixture of several different substances, only one of which is entitled to the name of cocaine. 2. That the separation of normal cocaine from its accompanying alkaloids can only be affected by processes of crystallization, either of the alkaloid itself or some of its salts.

In concluding, I desire to express my obligations to the firm of Parke, Davis & Co. for the use of their laboratory facilities, and especially for the material aid rendered by them in supplying the illustrations that accompany these notes. I trust that some one more burdened with leisure than the writer will be found to pursue lines of inquiry that I have been able only to indicate, and that our knowledge of the alkaloids of erythroxylon will soon be as full and exact as that of the cinchona group.

DETROIT, MICH., August 24, 1885.

HOW TO DETERMINE THE PURITY OF COCAINE.

Physicians need scarcely be reminded of the importance of using in their practice products the purity of which is beyond question.

There can be no doubt that much of the diversity of opinion regarding the therapeutic action of drugs is due to the difference in quality of the preparations used by individual observers.

No more striking illustration of the variations in quality of the preparations of the same drug exists than is furnished by the cocaine products now offered for sale in the American markets. The great demand for this drug has resulted, as might have been anticipated, in the production of crude, hastily prepared, impure forms of cocaine, the use of which often leads to disappointment and mis-conception of the real utility of this important anæsthetic agent.

In view of these facts it may not be uninteresting to our readers to learn that a simple test of the comparative purity of crystallized cocaine exists in its odor. Dr. A. B. Lyons, of Detroit, has found that a carefully prepared crystallized muriate of cocaine is entirely free from odor, while the impure, imperfectly crystallized muriate has the peculiar characteristic smell of the coca leaves.

The crystallized cocaine hydrochlorate from the laboratory of Parke, Davis & Co., is entirely odorless and perfectly crystallized, indications of its purity, which we learn from the reports in the current medical press have been amply substantiated by clinical proof of its activity and freedom from irritating effects.

In an analysis of the various brands of cocaine on the the market, made by Dr. A. B. Lyons, and published in *Medical Age*, July 25, 1885, appear the following notes, which will serve as a guide to the reader as to the purity and desirability for use of any given product of cocaine.

1. Product of Parke, Davis & Co.—A bulky, white, crystalline powder. Under the microscope it is seen to be made up of distinct crystals, the facets of which are visible also to the naked eye. It is either perfectly white, or with a faint greyish or creamy tint. It is wholly odorless, and has a saline, faintly bitter taste. It is not at all hygroscopic (*i. e.*, does not absorb moisture on exposure to a damp atmosphere), is very readily and wholly soluble in water, producing a colorless solution which is neutral to test paper. It contains 89 per cent. of alkaloid which can be removed by washing out the alkaline solution with ether, and which, on the evaporation of the ether, all crystallizes, leaving no gummy substance, as the last portions of the solution evaporate. The alkaloid is also free from odor.

2, Product of Merck.—A more or less crystalline powder, of a distinct cream color, in all the samples I have seen, not always wholly free from odor, and, at least in

some instances, producing a solution in water which is opalescent. Otherwise agreeing with No. 1.

3. Product of W. H. Schieffelin.—Somewhat crystalline powder, of a brownish tint, having a faint tobacco-like odor, characteristic of the crude alkaloid from coca leaves. The solution in water is rather strongly tinted, and has a much more bitter taste than that of pure cocaine muriate. The alkaloid obtained from it nearly all assumes the crystalline form, and the quantity is very near that which theory would require. Ether does not, however, take it up so rapidly as it does the crystallizable alkaloid.

4. From Lehn & Fink, who are not manufacturers. Probably of German manufacture. Resembles the last, but is nearly white, and has only a very faint odor.

5. Product of E. R. Squibb.—A yellowish-white powder, amorphous, somewhat hygroscopic, having a strong tobacco-like odor and flavor. Dissolves in water to a clear and nearly colorless solution, but not perfectly soluble in absolute alcohol. On submitting the sample to a process of crystallization, about 85 per cent. was obtained in the form of yellowish-white crystals nearly free from odor, while the residue on evaporation formed a soft substance, partially fusing at a water-bath heat, very hygroscopic, and having the disagreeable odor already spoken of, in a very high degree.

The manufacturer of this product, who has published in detail the processes he employs, holds peculiar views in regard to color as an evidence of purity in alkaloidal salts. "The dazzling whiteness of some of the salts of the alkaloids," he says, "such as those of morphine and quinine, is very beautiful, but desirable only from an æsthetic point of view, since it adds nothing to the effects of the salts. Indeed, the processes by which it is attained are often, if not always, damaging to the alkaloids."—(*Ephemeris*, January 12, 1885.)

That one having his large experience as a manufacturing chemist should make such a statement is a matter of surprise to us. We are often told by old housewives that "there is no strength in the highly refined sugars we get now-a-days." The chemist does not enter into any argument on the subject, but his faith in the sweetening power of white crystallized sucrose is not a whit disturbed, and he still uses in his—lemonade—"best granulated rather than even "A coffee," and philosophizes to himself on the power of superstitious notions, the genesis and evolution of which he is interested to study as a curious psychological phenomenon. But to find the superstition of the ignorant housewife lurking in the laboratory of the practical chemist, gives his philosophizing an introspective turn. "Are we, too, of the common clay?"

In fact, one needs very little experience in the manufacture of alkaloidal salts to learn that "dazzling whiteness" is, almost of necessity, evidence of careful and skillful manipulation, and that the process by which it is attained, while they may reduce the quantity of the yield, and so prove damaging to the profits of the operator, are not often, if ever, "damaging to the alkaloids."

The manufacturer has himself explained the various steps of the process by which this product is made, and these certainly do not include any efficient methods of separating impurities. The solution of crude muriate is treated with animal charcoal, by which it is deprived of coloring matters, and possibly of certain other impurities. Aside from this the only means adopted for separating hygrine and other impurities is a process of fractional saturation, the portion of alkaloid first taken up by a small quantity of acid being assumed to contain the impurities. The result is what might be expected. The obvious expedient of crystallizing the product would solve the problem in a much more satisfactory manner, and is, indeed, the only ready way of separating mixtures of organic principles, like the crude products obtained in the treatment of the coca leaves.

6. Product of McKesson and Robbins.—An amorphous powder, less bulky than No. 5, but resembling it closely in odor and color—a few shades darker, however. Impurity is

shown by color, by odor, and by the fact that the alkaloid separated is only partially crystallizable, and the salt itself, on submitting it to a process of crystallization leaves a soft, hygroscopic residue. All of these samples consist wholly of *crude* cocaine muriate. The impurities are like those of muscovado sugar—consisting probably of derivative or alterative alkaloids, which may be identical in physiological and in therapeutic action with the original cocaine. The fact, however, that physicians have found solutions of the amorphous salt to produce abscesses when injected into the cellular tissues, while solutions of the crystallized salt did not produce this disagreeable effect, proves that there are impurities present in the former which do not coincide in their action with the cocaine salt, and which ought by all means to be eliminated.

7. Product of Glover & Nichol.—An amorphous, fawn-colored powder, having an alkaline reaction, free from odor, the taste resembling that of sodium carbonate. Readily soluble in water, forming a colored solution, which produced nothing of the physiological effects of cocaine. On adding an acid to the solution brisk effervescence was produced, carbonic acid being evolved. Qualitative tests showed the presence, besides carbonates, of sulphates, chlorides and borates. The salt consisted almost wholly of inorganic matter, chiefly of carbonate of sodium, and contained hardly a trace of alkaloid. For five grains of this worthless material I paid \$1.50. I am not sure that the transaction, however, was a profitable one for Messrs. G. & N. It has at least insured the firm a good deal of free advertising.

REPORTS OF THE USE OF COCAINE IN GENERAL AND MINOR SURGERY.

Cocaine has been extensively used in general and minor surgery and its applicability for all minor surgical procedures amply demonstrated.

Indeed its utility is not confined to minor surgery, since its anæsthetic action can be exerted on the deeper tissues by its hypodermic use, though it is not to be supposed that it can usurp the place of ether or chloroform in grave operations requiring considerable time for their performance.

Dr. R. J. Hall, of New York, in a letter published in the *New York Medical Journal*, December 6th, 1884, reports the use of cocaine in a variety of operations as follows, viz:

Wishing to use the hydrochlorate of cocaine in some small operations at the Roosevelt Hospital Out-door Department, I made some experiments on myself, to determine the best mode of using it. The preparation was a four-per-cent. solution made by Parke, Davis & Co. Injecting subcutaneously six minims on the dorsal surface of the forearm, at the junction of the middle and upper thirds, near the ulnar border, caused complete loss of sensation over an area extending *downward* as far as the lower end of the ulna, from three quarters of an inch to an inch wide above, and half an inch wide below, obviously following the distribution of a cutaneous branch of the ulnar nerve. There was no diminution of sensibility above the point at which the needle was introduced. A number of subsequent experiments showed that the anæsthesia extended over the region supplied by the cutaneous nerves near or into which the injection was made. Thus, in a number of experiments made by Dr. Halsted and myself, we have found that, injected subcutaneously into the leg or forearm, not in the neighborhood of any large nerve-trunk, it will cause anæsthesia for a distance of two or three inches below the point of injection. An injection into the musculo-cutaneous nerve of the leg, at the point where it pierces the deep fascia, caused anæsthesia over all that portion of the leg and foot supplied by this nerve. An injection of eight minims into my left ulnar nerve at the elbow had no effect. An injection of thirty-two minims into the right ulnar nerve at the elbow caused, in two or three minutes, numbness and tingling down the forearm and little finger, and in five or six minutes anæsthesia extending down the ulnar border of the forearm and hand and over the little finger, with much reduction of the sensibility on the ulnar border of the ring-finger. There was an anæsthetic area over the olecranon and the posterior surface of the external condyle, which we should not expect to be supplied by the ulnar nerve. There was no apparent diminution of muscular power, and no anæsthesia of the skin at the point where the injection was given. We have noticed that, when the needle is thrust into the deeper layers of the subcutaneous connective tissue, there is usually no loss of sensibility at the point where the needle was introduced.

With the anæsthesia, marked constitutional symptoms appeared; about six minutes

after the injection there was giddiness, at first slight, then well-marked, so that I could not walk without staggering; and finally there was quite severe nausea, which would have been much worse, I think, had not the stomach been empty. At the same time, the skin was covered with cold perspiration, and the pupils were dilated. The nausea passed off, with the local anæsthesia, in about twenty minutes, leaving some dizziness for an hour or so longer.

The same evening Dr. Halstead removed a small congenital cystic tumor, situated directly over the outer third of the left supra-orbital ridge, and believed to be a meningocele, the communication of which with the cranial cavity had become shut off. Nineteen minims of the four-per-cent. solution were given hypodermically in divided doses, one external to the tumor, and the others close to the supra-orbital notch. In about five minutes the anæsthesia was complete. The incision through the skin and the earlier steps of the operation were not felt at all, but, in consequence of the close adhesions of the sac and its extensive prolongations, especially into the upper lid, the operation was somewhat protracted, and the anæsthesia had passed off to a considerable extent before it was completed. I was informed of a case, occurring on the same day, in which cocaine was injected, preparatory to performing a small plastic operation, in the same region, but no anæsthesia of the field of operation was produced. On inquiry, I was told that the injections had been given *above* the point where the incisions were to be made.

This afternoon, having occasion to have the left first upper incisor tooth filled, and finding that the dentine was extremely sensitive, I induced Dr. Nash, of No. 31 West Thirty-first street, to try the effects of cocaine. The needle was passed through the mucous membrane of the mouth to a point as close as possible to the infra-orbital foramen, and eight minims were injected. In two minutes there was complete anæsthesia of the left half of the upper lip and of the cheek somewhat beyond the angle of the mouth (as I was in the dentist's chair, I could not determine the exact limits), involving both the cutaneous and the mucous surfaces; also of the left side of the lower border of the septum nasi and of the anterior surface and lower border of the gums, extending from the median line to the first molar tooth. Forcing the teeth apart with a wedge caused no pain except when the wedge impinged on the unaffected mucous membrane of the posterior surface of the gums. Dr. Nash was then able to scrape out the cavity in the tooth, which had previously been so exquisitely sensitive, and to fill it, without my experiencing any sensation whatever. The anæsthesia was complete until twenty-six minutes after the injection, and sensibility was much diminished for ten or fifteen minutes longer. Piercing the mucous membrane with the needle caused pain like the prick of a pin, but its subsequent introduction until it struck the bone and the injection of the solution were not felt. In the same way, the introduction of the needle into the ulnar nerve caused quite severe pain, with tingling down to the little finger, but the injection of the fluid gave rise to no sensation. In the experiment on the teeth, it surprised me that the incisor tooth should be rendered insensitive, as the anterior-superior dental nerve is given off in the infra-orbital canal. I can only suppose that the effect extends some distance along the nerve centrally, or that the fluid traveled along the sheath of the nerve into the canal.

We have already used this mode of administration successfully in a number of cases in the Roosevelt Hospital Out-door Department, and it is obvious that, when the limits of safety have been determined, it may find very wide application. For instance, in addition to the usual application to the conjunctiva, in operations on the eye, an injection into the orbit in the neighborhood of the ciliary nerves, would doubtless diminish the liability to a very grave accident, which, I understand, has already occurred several times in the city—namely, the extrusion of the lens, from blepharospasm, occurring during iridectomy performed with the aid of cocaine. We have injected twenty minims a number of times without causing any constitutional symptoms.

Postscript, December 1st.—Since the foregoing was written we have made some additional experiments which seem of interest. Dr. Halsted gave Mr. Locke, a medical student, an injection of nine minims, trying to reach with the point of the needle the inferior dental nerve where it enters the dental canal. In from four to six minutes there was complete anæsthesia of the tongue on the side where the injection had been given, extending to the median line and backward to the base as far as could be reached with a pointed instrument. There was, further, complete anæsthesia of the gums, anteriorly and posteriorly, to the median line, and all the teeth on that side were insensitive to blows. The soft palate and the uvula, on the same side, were anæmic and quite insensitive. Mr. Locke thought also that there was some diminution of sensibility in the domain of the auriculo-temporal nerve.

In four or five other cases where the injection was made in the same way, from fifteen to twenty minims being used, the fluid seemed to come nearer the lingual than the inferior dental. In all, the tongue was affected sooner than the gums; the anæsthesia extended as far back as the epiglottis, and the sense of taste was abolished on the affected side; and the posterior surface of the gums was earlier and more completely anæsthetized than the anterior.

This evening Dr. Halsted gave me an injection of seventeen minims, the needle being introduced along the internal surface of the left ramus until it touched the inferior dental nerve, causing a sharp twinge along the whole line of the lower teeth. In three minutes there was numbness and tingling of the skin, extending from the angle of the mouth to the median line, and also of the left border of the tongue. In six minutes there was complete anæsthesia of the left half of the lower lip, on both the cutaneous and the mucous surfaces, extending from the median line to the angle of the mouth and downward to the inferior border of the jaw. A pin thrust completely through the lip caused no sensation whatever. There was also complete anæsthesia of the posterior surface of the gums and of the lower teeth on the left side, exactly to the median line; hard blows upon the teeth with the back of a knife caused no sensation. The anterior surface of the gums was anæsthetic only from the median line to the first bicuspid. There was a small area of complete anæsthesia, about the middle third of the left border of the tongue, not more than an inch in diameter. A slight return of sensation began twenty-five minutes after the injection, and five minutes later no complete anæsthesia remained anywhere. I should mention that fifteen to twenty minims in this region caused, in two or three cases, slight constitutional symptoms similar to those previously described.

MURIATE OF COCAINE IN GENERAL SURGERY.*

Dr. J. W. Stickler, of Orange, N. J., wishing to know the effect of cocaine hydrochlorate upon the skin and underlying tissues, had the following experiment tried upon himself by Dr. T. Y. Simpson: Dr. S. injected with an ordinary hypodermic syringe four and one half minims of a four-per-cent. solution of the alkaloid under the skin of the forearm. After the lapse of five minutes, the point of a knife was applied to different parts of the skin immediately over, and adjacent to, the point of puncture, with the following result: Partial anæsthesia of the skin *along the line of the injection*, most marked at the point where the fluid was deposited in the tissues, that is, at the precise point where the cocaine was forced from the point of the hypodermic needle. On either side of this line the partial anæsthesia extended about one-eighth inch. As the anæsthesia did not become more pronounced after waiting another five minutes, a second injection of five minims was made. The needle was inserted at a point just beside, and parallel with, the first, but forced deeper into the tissues (one inch). At the end of five minutes,

* New York Medical Record, Dec. 13, 1884, p. 657.

the same superficial test was applied as in the first instance, the face being turned aside so as not to see the application of the knife. Sensation seemed about normal except in a band of integument, nearly one inch long, and half an inch wide, the maximum superficial anæsthesia existing along the line of the opening made in the tissues by the hypodermic needle. The hyperæsthetic line bounding the anæsthetic area (referred to by Dr. Hepburn, in the *Medical Record*, Nov. 15, 1884) I could not define in my own case, and there did not seem to be *increased* sensitiveness at *any* point within the limits of that portion of the skin slightly congested by the action of the drug. After 13 minutes had elapsed from the time of puncture, the doctor transfixed with a surgeon's needle the anæsthetic skin, without producing the *slightest* pain. The needle being withdrawn, an incision was slowly made with a scalpel through the entire thickness of the skin and cellular tissue, producing *so little sensation of any kind* that, had my attention been otherwise engaged, I doubt if I would have known that the doctor was cutting me. This cut was made along the line of the injection, and about corresponded in extent with the length of the hypodermic needle. The wound was left open for about four minutes, when the needle was slowly introduced, at a point midway between the two extremes of the cut, into the deeper tissues. Absolutely *no sensation* was experienced till the point of the needle entered the sheath of one of the extensor muscles. That the muscle was penetrated was evident from the motion given the needle when the muscle was exercised. The pain occasioned by contact of the needle with the muscular tissue was very slight. About five minutes later, sutures were introduced without pain, but produced a sense of pressure such as Dr. Wright said he felt when a needle was thrust into the skin of his forehead (*Medical Record*, Nov. 22, 1884). The anæsthesia remained well pronounced half an hour. Twenty minutes after the second injection there were slight muscular tremors; other than these, there were no evidences of systemic disturbance. It is interesting to observe that when the hypodermic needle is made to traverse a direct course through the skin and cellular tissue, the hydrochlorate of cocaine does not infuse itself equally in every direction, but follows quite definitely the channel made for it by the needle, producing anæsthesia along this line, but to a very limited extent on either side of it. In opening an abscess, or in making any straight incision, this circumstance would find a practical application. A much larger area of skin could be rendered anæsthetic by one injection, if the cellular tissue were made more permeable by moving the point of the injecting needle from side to side after its introduction.

Dr. J. R. Uhler, of Baltimore, Md., says that on November 1st he published some experiences with muriate of cocaine in general surgery. In all cases it produced more or less superficial anæsthesia, but acted better on thin mucous membranes than on unbroken skin. Upon the rectum, when freely used, besides benumbing the parts, it produced in two cases a rigid tonic contraction of the sphincter ani, which had previously been relaxed, and contraction of the longitudinal fibers of the gut, pulling up the mucous membrane, which before had protruded. So firm was the contraction that the sphincter stood out like a ring, and the finger could with difficulty be made to enter it. For vaccination and small operations upon the skin, the following plan was tried in two cases and found satisfactory: First, a few drops of a strong solution of the drug were painted on the skin where it was intended to be cut, and after the lapse of a few moments the knife, dipped in some of the solution, was passed gently over the part, so as to denude only a few of the outer cells of the skin, but not penetrating deeply enough to cause hæmorrhage or pain. Over this minute abrasion or cut, which was made to allow the drug to get nearer the nerve, and be absorbed, some of the solution was painted, and after a short interval the operation was proceeded with, the patients making no complaints. Where mucous membranes are hard and very thick, it will act slowly or imperfectly, unless used by hypodermic injection, anæsthesia is most plainly perceived

where nerves are most thickly distributed. In a case of labor reported in the *Maryland Medical Journal*, I purposely avoided applying cocaine to the mouth of the uterus, as I feared that tetanic rigidity of the organ might be produced.

HYDROCHLORATE OF COCAINE IN MINOR SURGERY.*

Contributions as to the use of the hydrochlorate of cocaine as a local anæsthetic are now of value in as much detail as practicable. I therefore beg leave to state that, assisted by Dr. T. Mitchell Prudden, Director of the Pathological Laboratory of the College of Physicians and Surgeons in New York, and Lecturer on Histology in this college, I to-day removed a small tumor about the size of a marrowfoot pea (suspected epithelioma) from the cheek of an elderly lady, without causing her any appreciable pain during the operation, by the use of this drug. I first injected subcutaneously five minims of a four per cent. solution of the drug, and after waiting ten minutes, as she said she still felt the point of the hypodermic needle perceptibly, I repeated the dose. At the end of ten minutes more, as she said she still felt the needle, I injected five minims more *into* the skin. It required some force to the piston of the syringe to inject this into the firmer tissue. At the end of five minutes more I began the cutting; the patient said she "felt it, but it didn't hurt—it felt like scraping." The piece removed was about three-quarters by half an inch. There was quite a free hæmorrhage from the little wound, and I waited fully five, perhaps eight minutes for that to subside, when the sutures were introduced. She then exclaimed, "there! that hurts! that is worse than anything I have felt yet!" After dressing the wound, the time from the first injection was thirty-five minutes. As she left the office she expressed herself as experiencing a sense of exhilaration; "felt much better than when I came in."

It is unnecessary to enlarge upon the prospect thus opened to us certainly in the field of minor surgery, aside from its uses in ophthalmic practice, if the reports so far given of the effects of this new anæsthetic should be confirmed by further experimentation. I desire to record my experience of its action as applied to the external skin, and to point out that (I think) I found a better effect by injecting the solution *into* the skin rather than under it.

HYDROCHLORATE OF COCAINE IN MINOR SURGICAL PROCEDURES.†

The reputation of the new anæsthetic, cocaine hydrochlorate, is thoroughly established so far as its application to the eye is concerned. But much remains to be determined with regard to its usefulness in other branches of surgery. As a contribution, therefore, to the general fund of knowledge concerning the action of this valuable drug I herewith offer a brief account of several different cases in which I have very carefully noted its effects:

CASE I.—Three weeks ago I was called upon to operate upon a very large and painful hydrocele, complicated with inguinal hernia. The patient agreed to allow me to operate without ether. Accordingly, I brushed a few drops of a four per cent. solution of cocaine hydrochlorate over the right side of the scrotum, and, two minutes after, I inserted, at points one inch apart, by means of a very fine hypodermic needle, three drops of the four-per-cent. solution. At the end of ten minutes I made an incision one inch in length through the tissues into the tunica vaginalis, and then removed by excision a considerable mass of thickened membrane, etc. The operation was *entirely painless*, the patient being unaware of the time of the several incisions, etc.

* W. H. Carnalt, M. D., Professor of Surgery in the Medical Department of Yale College, in *Med. News*, Nov., 1884.

† Malcolm McLean, M. D., in *N. Y. Med. Journal*, Jan., 1885.

CASE II.—Miss H., aged twenty-two, presented herself at my office, on account of a "tumor," which, she said, interfered with her walking. I found a cystic tumor of the left labium minor as large as a hen's egg. I did not warn the patient of my intention, but painted the ostium vaginæ and the left labia with the four-per-cent. solution. In *five minutes* I cut through the mucous surface of the labium, and emptied and cleansed the sac. The patient was not aware that *any operation whatever* had been done.

CASE III.—A child a few months old had symptoms of periosteal abscess of the left humerus. I inserted two drops of a four-per-cent. solution hypodermically on the outer aspect of the arm, which, of course, caused the child to cry somewhat, as the whole arm was much swollen and very tender. In *three minutes* I carried a sharp-pointed bistoury down to the bone, incising the periosteum and evacuating pus, without producing evidence of pain. There was no catching of the breath, nor sudden outcry, such as we observe when an infant is suddenly hurt.

CASE IV.—Mrs. P., aged twenty-five years, has an infant four weeks old. She has been suffering for several days with pains in her right breast, high fever, night-sweats, etc. To-day I painted a small space on the lower segment of the breast with the four-per-cent. solution, and in two minutes I inserted hypodermically, without pain, three drops of the same solution, and in three minutes more I made a free and deep incision, discharging a teacupful of pus. The patient was exceedingly nervous, but said emphatically that the operation was *absolutely painless*.

These cases seem to me to suggest a wide field of usefulness for this new boon to humanity, as the hypodermic applications seem to offer great possibilities.

ON THE USE OF COCAINE IN MINOR SURGERY.*

Considerable has been written and said during the last few months, in the journals and elsewhere, relating to the use of this new drug. Its use in medicine is of recent origin, as it has only been known to the profession since October 1884.

As time passes, however, this drug seems to be gaining a firmer foothold in therapeutics, and its field of usefulness is constantly widening the better it becomes known. Almost every day we hear of some new application to which this new remedy has been put, and in which it has been found decidedly useful.

Since its discovery, or rather its application to medicine, in October 1884, it has been used by a large number of physicians both in surgical and in medical practice.

I have used the drug in two cases in minor surgical operations. The most important evidence in its favor, however, is based upon notes obtained from the surgical practice of Dr. George Wackerhagen, of this city.

CASE I.—This was that of an adult 45 years of age, and a case of phimosis. The operation was done under somewhat peculiar circumstances, as it was not in reality a necessary one. The patient had recently had two of his sons operated upon, and partly for that reason and partly because he was a man of some scientific acquirements and was anxious to test the efficacy of cocaine, he was desirous of having the operation performed—so much so that he told the doctor that if he would not perform it he would get some one who would. Under these circumstances Dr. Wackerhagen consented. As the patient was determined to be a martyr to science, the doctor would not deter him. A four-per-cent. solution of the hydrochlorate of cocaine was introduced hypodermically at the dorsal base of the penis, on either side, simultaneously painting the prepuce thoroughly, two or three times, over the point where the incision was to be made, after which he waited for 15 minutes to get the desired effect. At the expiration of this period there was still some tenderness of the fore-

* Read before the Brooklyn Pathological Society, March 12, 1885, by Henry Tuthill Halleck, M. D., Brooklyn.

skin, when the forceps were applied for the purpose of extension. Five minims more were introduced hypodermically. Soon the penis became numb, cold, and blue. Five minutes later the doctor commenced the operation, using a clamp after the usual custom in operating for phimosis. This patient did not have the slightest pain during the operation, according to his own statements. He said, further, that he would not have known that the operation was being performed if he had not been looking at it.

CASE 2.—Another adult, 28 years of age. This was a case of stricture of the urethra. Dr. Wackerhagen commenced the operation by introducing 30 minims of the hydrochlorate of cocaine with a urethral syringe, after warld closing the meatus and holding it so as to prevent any escape. Then he injected 10 minims into the tissues at the dorsal base of the penis. After waiting a sufficient length of time for the anæsthetic to take effect, he introduced the urethrotome and cut up to No. 37, French measure, the patient having no pain. He then introduced a bougie, and found the stricture had not been fully divided. The urethrotome was reintroduced and the stricture cut to 40, watching at the same time for any symptom of pain that should manifest itself. At this cutting the patient did complain of some pain, but said it was very slight. So little pain did he experience, according to his own statement, that he would not think of taking ether were the operation to be performed again.

CASE 3.—This was another case of urethral stricture in the male adult. It was very similar to the last, but here no hypodermic of cocaine was used. Thirty minims (ten minims three times, ten minutes apart) of a four-per-cent. solution of hydrochlorate of cocaine were introduced into the urethra and retained for a sufficient length of time to produce anæsthesia, after which the urethrotome was introduced and the canal cut to No. 40 in the French scale. The urethra was cut from three inches and-a-half back of the meatus to the corona. This man manifested no symptoms of pain during the operation.

Another marked feature from the use of this drug was that no chill was experienced in any of the foregoing cases, and in all, especially in the operation for phimosis, its marked hæmostatic action was readily apparent.

CASE 4.—This patient was also an adult, with an ulcer of the rectum. He was a man of 42 years. The anæsthesia in this case, however, was a failure, the effect was nil, and the patient complained of pain all through the operation. The mucous membrane of the rectum was painted with a four-per-cent solution as high up as could be reached. No hypodermic was employed. After waiting for 20 minutes for the anæsthetic to take effect, the operation was commenced. The patient complained that he felt the pain just as keenly as if nothing had been used. The non-success of the drug in this case was attributed to two causes: first, that the preparation used was of American manufacture, whereas in all the former cases the foreign make had been used; secondly, to the much greater difficulty of properly applying the drug to the mucous membrane on account of the locality. The doctor finished the operation while the patient uttered maledictions on the drug.

Dr. Wackerhagen remarked that he preferred not to use it in the case of children, for the reason that it would be impossible to keep them still enough to operate with any degree of satisfaction, even when absolutely no pain was produced.

CASE 5.—This was the case of a man, 32 years of age, affected with urethral spasm, who was taken to New York to see Dr. Fessenden N. Otis. He also had a stricture. Dr. Wackerhagen demonstrated to Dr. Otis that a No. 7 sound was *firmly* held in the urethra by the spasm. After removing the No. 7 sound, however, and injecting about 30 minims of the hydrochlorate of cocaine and waiting for an appropriate length of time, a No. 28 sound would slip out and in easily. Several other New York surgeons were present and witnessed the operation, which was eminently successful in two ways: first, by proving that the drug could relax spasm, and, secondly, that there are sometimes strictures with spasmodic complications.

For notes of the two following cases I am indebted to the kindness of my friend, Dr. A. H. P. Leuf:

CASE 6.—This patient was a young man with an old sebaceous cyst, located over the right sterno-mastoid muscle. The offending body was inflamed and pointing, and surrounded by a wall of inflammatory new formation about half an inch thick. The skin was repeatedly painted with a four-per-cent. solution of the hydrochlorate of cocaine for some time before operating. Five minims were injected hypodermically on either side of the sac. The anæsthesia produced here was so very superficial and unsatisfactory that the operation was continued under ether. It is possible that a stronger solution might have been used with a better result.

CASE 7.—This was the case of a young English surgeon, from whose tarsal cartilage Dr. Leuf removed a small tumor. This tumor was of about the size of a pea. The cutaneous surface of the upper eyelid was thoroughly painted with the solution, by means of a small brush, several times before the operation was commenced. The incision was made and the cocaine was continually applied, waiting by spells for the anæsthetic to take effect. He proceeded very slowly with the operation, which he was compelled to do in consequence of these interruptions, and, after all the care that was exercised in this case, much pain was evinced, and the anæsthesia was very unsatisfactory. Dr. Leuf stated that under the influence of ether the operation ought not to have taken more than five minutes, whereas with the cocaine it took nearly an hour, the pain being felt almost as acutely as if no anæsthetic had been used. No hypodermic injection could be given on account of the locality.

The next and last two cases which I shall relate occurred in my own private practice. These were more satisfactory than those in which Dr. Leuf used the drug.

CASE 8.—This was that of a youth 19 years of age. The operation was for phimosis. The foreskin was not so tightly contracted but that the mucous membrane could be easily reached with a fine camel's-hair brush and painted, which I did very thoroughly with a four-per-cent. solution of the hydrochlorate of cocaine. This was repeated several times, and I waited for fully half an hour before operating, painting the foreskin, both on the mucous membrane and on the cutaneous surface, at very short intervals during the whole half hour. I did not use any hypodermic injection in this case. I had given the patient his choice before the operation whether he would take ether or would have the cocaine, and he preferred the latter. The pain he experienced was extremely slight during the cutting part of the operation, the sutures causing somewhat more, but not enough to give rise to any very serious discomfort. He said he greatly preferred it to ether, which he had taken on a preceding occasion. The operation performed was that of Professor Wight. I also noticed that the hæmostatic effect in this case was good. The hæmorrhage was far less than in those cases in which I have used ether as the anæsthetic.

CASE 9.—This was that of a lady who very much dreaded to go under the influence of ether. The removal of a sebaceous cyst from the scalp was to be the operation. I doubted the efficiency of cocaine very much in this locality; however, I resolved to give it a trial, and, as I could not hope to produce any anæsthesia from its external application, I accordingly injected with my hypodermic needle 14 minims of four-per-cent. solution of hydrochlorate of cocaine. Seven minims were injected at the anterior base and seven minims at the posterior base of the tumor. I then waited for 25 minutes for the cocaine to take effect. On making the linear incision, the patient felt some pain, and, as the spot was not particularly a sensitive one, I doubted somewhat whether the cocaine had anything to do with relieving the pain. However, on pulling out the sac, I thought that the sensation was very much deadened. She complained of some pain it is true, but did not make half the fuss I expected.

I have also applied cocaine to the mouth with very good effect in one case. It was that of a child only a few months old. It was teething, and I rubbed the swollen gums with

my index-finger, first moistened with the solution of cocaine. The child appeared decidedly easier after a quarter of an hour or so, and ceased crying after having it applied a second time. My experience with cocaine has been fairly satisfactory, and I shall continue to use it whenever I think it practicable.

There seems to be a goodly number of conflicting statements with regard to its efficacy, but whether only apparent or real remains to be demonstrated. One strong point in its favor is, that in every case where it will take the place of ether it does not leave the patient sick for hours afterward, as is usual after the use of that anæsthetic.

It would also be an interesting point to learn just how strong a solution could be used with safety to the patient to avoid sloughing, gangrene, etc., which might possibly be the effect if too strong a solution should be used, because of its astringency and possible effect upon the trophic nerves. Its application in medicine is likely to be far more extensive than in surgery, and any method by which its field of usefulness can be extended, whether by experiment or otherwise, is certainly praiseworthy.

Numerous cases have been reported in which cocaine has been used with great success in general and minor surgery. Some of these will be cited more appropriately under the different special divisions of medical and surgical practice.

COCAINE IN OPHTHALMOLOGY.

As is well known it was in this branch of practice that the great utility of cocaine as an anæsthetic was demonstrated by Dr. Koller—and in this connection it may be of interest to present Dr. Koller's original paper which he read before the Medical Society of Vienna, and published in the *Wien. Med. Wochenschr.*, October 25, and November 1, 1884, a translation of which we take from Dr. H. Knapp's recent work entitled, "Cocaine and Its Use in Ophthalmic and General Surgery," p. 1, *et sequitur* :

I want to report some experiments which I have made in regard to anæsthetizing the eye. This is not my first communication on the subject—a previous one, to secure priority, having been directed to the meeting of German oculists held at Heidelberg Sept. 15th and 16th of this year. Dr. Brettauert, of Trieste, was kind enough to deliver my paper to the Publishing Committee, and to exhibit before the Society my experiments, which have since been repeated and confirmed in different places of Germany.

It is generally known that cocaine, the alkaloid separated from the leaves of *erythroxylon coca*, in 1859, by Niemann, a pupil of Wöhler, possesses the remarkable property of rendering, on local application, the tip of the tongue anæsthetic. This property was discovered by Prof. Schroff, who first, in 1862, mentioned it before this Society. It is further known that cocaine, through the circulation, contracts the peripheral arteries, and it is known also that it dilates the pupil both through the circulation and on local application. From the foregoing it is evident that cocaine has been instilled into the eye in former years, but those phenomena have been overlooked which will be the subject of my present communication.

The internal application of cocaine, tried repeatedly, has always been abandoned again. In 1880 Dr. von Anrep¹ published an elaborate experimental paper on cocaine, at the end of which he points out that its local anæsthetic action may become of importance. To us Viennese physicians cocaine has been prominently brought to notice by the thorough compilation and the interesting therapeutic paper of my colleague at the General Hospital, Dr. Sigmund Freud.² Starting from the supposition that a substance paralyzing the sensitive terminations of the mucous membrane of the tongue could not greatly differ in its action on the cornea and conjunctiva, I have made in the laboratory of Prof. Stricker, a number of experiments on animals, of which, in brief, the following were the results obtained:

A few drops of a watery solution of muriate of cocaine;³ dropped on the cornea

¹ Pflüger's Archiv f. d. ges. Physiol., 21. Bd.

² Centralbl. f. Therapie v. Heitler, August number, 1884.

³ Muriate of cocaine dissolved up to five per cent. in water without addition of an acid, but always opalescent. Addition of acids is to be avoided, as a very small quantity of acid causes intense burning. The opalescent solution becomes as clear as water by filtration.

of a guinea-pig, rabbit, or dog, or instilled into the conjunctival sac in the ordinary way, cause for a short time winking of the eyelids, evidently in consequence of a slight irritation. After one-half to one minute the animal again opens its eyes, which gradually assume a staring look. If now the cornea is touched with a pin-head (in which experiment we have carefully to avoid touching the eyelashes), the lids are not closed by reflex, the eyeball does not move, the head is not drawn back as usual, the animal remains perfectly quiet, and on application of stronger irritation we can convince ourselves of the *complete anæsthesia of the cornea and conjunctiva*. In this way I have scratched and transixed the cornea of my animals used for experiment with needles, and have excited them with electric currents so strong as to cause pain in my fingers and become quite intolerable in the tongue; I have cauterized the cornea with a nitrate-of-silver stick until it became milky white—during all this the animal did not move. The last experiment convinced me that the anæsthesia involved the whole thickness of the cornea, and did not affect the surface only. But if I incised the cornea, the animals manifested intense pain when the aqueous humor escaped and the iris prolapsed. I have been unable, hitherto, to decide by experiments on animals whether or not the iris could be anæsthetized by dropping the solution into the corneal wound, or by prolonged instillations into the conjunctival sac; for experiments to test the sensibility of non-narcotized animals are very complicated and difficult, and do not yield unambiguous results. The last question which I subjected to experimentation on animals, viz: whether or not the inflamed cornea could be anæsthetized by cocaine, was answered in the affirmative. The cornea in which I had incited a foreign body became as insensible as the healthy one.

Complete anæsthesia of the cornea from the use of a two-per-cent. solution lasts ten minutes on an average. After such successful experiments on animals I did not hesitate to apply cocaine also to the human eye, trying it first on myself and some of my friends, then on a great number of other persons, obtaining without exception the result of a perfect anæsthesia of the cornea and conjunctiva. The course of the phenomena is as follows: If some drops of a two-per-cent. solution are instilled into the conjunctival sac, or better still, let run over the cornea, first a slight burning (accompanied by some lachrymation) is felt, which in one half to one minute disappears, being followed by a dull sensation of dryness. The eye, like that of the animals mentioned above, assumes a staring look, owing to a *considerable dilatation of the palpebral fissure*, a phenomenon to the explanation of which I shall return later on. If now the cornea is touched with the head of a pin, no sensation of *pain*, or of *contact* is experienced, and all *reflexes* are absent. The same holds of the conjunctiva, in which the sensation of *temperature* is likewise abolished. The scleral conjunctiva can be grasped with a pair of toothed forceps, or a dimple can be made into the cornea by pressure, without any unpleasant sensation or the least reflex on the part of the person thus treated; the only thing he perceives is an indistinctness of objects, owing, of course, to the change in the curvature of the cornea. This complete anæsthesia lasts from seven to ten minutes, then passes through a longer stage of reduced sensibility into the normal condition. About 15 or 20 minutes after the instillation the pupil begins to dilate. The dilatation reaches its highest degree within the first hour, decreases considerably in the second hour, and disappears without a trace in a few hours more. The pupil is never *ad maximum* dilated, responds promptly to light and convergence during the whole time, and for that reason the sensation of dazzling, connected with atropine mydriasis, is either totally absent or only slightly pronounced.

A very insignificant paresis of accommodation appears and disappears with the mydriasis; the near point receded $\frac{1}{2}$ " in myself and another person whom I examined on this point.

Furthermore I have observed a marked *ischæmia* in the normal, especially the

palpebral, conjunctiva, on the duration of which I am unable to make any definite statement. Other not perfectly ascertained observations, such, for instance, as the ophthalmoscopic condition, I will pass for the present, yet I want to say that I have never noticed any *symptoms of irritation* from the use of cocaine.

As to the dilatation of the palpebral fissure, this phenomenon at all events precedes the action of cocaine on the muscles of the iris and the ciliary ligaments. On account of its almost simultaneous occurrence with the anæsthesia of the cornea and conjunctiva, I have thought it to be in connection with this anæsthesia, accounting for it by the omission of the excitations which in the normal state act upon cornea and conjunctiva, and upon which the ordinary width of the palpebral fissure depends.

In regard to the anæsthesia I should not omit to mention some points of practical interest.

1. The anæsthetic effect of cocaine may be cumulated up to a certain limit, namely: if at the decrease of the anæsthesia cocaine is instilled anew, a second anæsthesia is obtained lasting longer than the first. In this way, by instillations every five minutes for a longer time, I have produced complete anæsthesia of from 15 to 20 minutes duration.

2. The anæsthesia is chiefly a local one, *i. e.*, it is most intense in those places which have been in contact with the solution directly and longest.

3. As it can be demonstrated that cocaine is absorbed, and that from each instillation a certain, though small, quantity penetrates into the eye, first of all into the anterior chamber, it could *a priori* be expected that the deeper structures of the eye might be anæsthetized if they could be reached by sufficient quantities of the remedy. But as the absorption requires a certain time, and the anæsthesia of the cornea is of short duration, the anæsthesia of the cornea will have disappeared before the iris and ciliary body are acted upon. We must therefore anæsthetize the cornea again. Both demands can be satisfied by successive applications. By instillations of a five-per-cent. solution made every five minutes and continued for about half an hour, I have succeeded in ascertaining an action upon the deeper parts of the globe, inasmuch as its sensibility on stronger pressure was essentially diminished.

I am indebted to the liberality of Dr. v. Reuss, acting surgeon of the clinic of the late Professor v. Jäger, for the opportunity of testing, during the last two or three weeks, the action of cocaine on diseased eyes.

From the beginning I have thought that therapeutically cocaine might be used in two directions: first, as a *narcotic in painful affections, of the eye*, and secondly, as an *anæsthetic in operations on the eye*.

In regard to the first category I have expected a good deal of benefit from its action in *diseases of the cornea and conjunctiva* accompanied by *pain* and *photophobia*. I have used cocaine in a greater number of patients suffering from lymphatic (phlyctenular) conjunctivitis with eruptions and ulcers of the cornea, and a two-per-cent. in one patient affected with frenulum vasculare (from successive phlyctenulæ). All patients thus treated have said that a few minutes after the instillations they have *felt* materially better, pain and photophobia having considerably diminished. With the same unanimity, however, they have complained that two or three hours after the instillation pain and photophobia have returned. It might therefore be expected that by applications repeated at such intervals pain and photophobia could permanently be removed or at least abated. This mode of application has not yet been tried. Under the conditions to which I have limited my experiments I have not noticed any influence on morbid processes either in the one or the other direction.

With similar result I have used cocaine in a man with painful *erosion at the sclero-corneal junction*.

I should think that cocaine might exert its influence also on the *pain in iritis*, for I believe to have demonstrated that its anæsthetic effect extends in a certain degree to the iris and ciliary body. The mydriatic effect, on account of its insignificance, would not merit great consideration, but we may expect some influence from its property of contracting the blood-vessels. The combination with atropine treatment may, perhaps, be of advantage. I have not yet had an opportunity to try it in this disease.

The sensation of pain from cauterizing the lids with nitrate of silver can, by previous instillation of cocaine, either be entirely suppressed or at least materially weakened. The majority of the patients in whom this treatment has been tried, have alleged to have felt no pain at all; in others the pain, after a period of latency, has reappeared, but could be suppressed again by a repeated instillation. One patient said the pain had been much less severe, but had lasted longer.

On the utility of cocaine in the bluestone treatment my observations are few in number and contradictory; at any rate it should here be used much more freely than in touchings with nitrate of silver in solution.

I come to the second category of the use of cocaine, viz.: as an *anæsthetic in operations on the eye*.

It does excellent service in the *removal of foreign bodies from and out of the cornea*, often a difficult task on account of the restlessness of the patient. In a large number of such patients (about 30) I produced the anæsthesia by letting two drops of a two-per-cent. solution run over the cornea while the patient was looking down. The instillation was repeated in from three to five minutes. All these patients have asserted to have lost the sensation of a foreign body; they held their eyes entirely quiet while the foreign body was dug out of the cornea with a needle, and, on being asked what they had felt, all have answered that they have felt nothing at all.

With the same good result cocaine has been used in a case of *tattooing corneal scars*, and in an *operation for pterygium*.

Good results may be expected in *cauterization of corneal ulcers* with the glowing iron, in *paracentesis of the cornea*, and in *discision of cataract*. Both the latter operations, as I have noticed in experiments on animals, and also in man, can be made absolutely without pain, for they consist only in fixing the conjunctiva and puncturing the cornea.

Dr. v. Reuss has performed *staphyloma operation* in a boy of ten and a girl of seven years without narcosis, but only by the use of cocaine after the method to be described presently. The children have kept perfectly still, and, according to their own statement, have experienced no pain.

Dr. v. Reuss was further kind enough to allow me to use cocaine in eyes on which he was to perform *iridectomies* and *extractions of cataract*. On the whole, I would like to say only that all these cases ran their *course without irritation*, a fact which certainly encourages to further trials. The experiments yielded more or less favorable results, but always corresponding to the intensity and manner in which the remedy was applied. The most favorable, as to painlessness during the operation, indeed almost entirely satisfactory, results were obtained in those cases in which the following method was strictly pursued: During half an hour immediately before the operation, two drops of a five-per-cent. solution were instilled every five minutes. The head of the patient lies horizontal, and while he looks toward his feet, his upper eyelid is raised and the solution dropped on the upper part of the sclerotic.

One of the patients, a woman, on whom an extraction of cataract was performed, stated, on being questioned at the different steps of the operation, that she felt nothing at all of the corneal section; she did feel it when the iris was seized and drawn out, but it pained her only a little. There was no reaction during any of the steps of the opera-

tion; the same was the case with a weak-minded woman on whom the same operation was performed, which Dr. v. Reuss had dreaded on account of her great sensitiveness.

The following case seems to me remarkable on account of its peculiar conditions:

A man with seclusion of the pupil on both sides underwent an iridectomy on the left eye after cocaine application. There was not the least reaction during the operation, and he said that he had not felt at all the corneo-scleral section (with the lance); he had felt the seizing and drawing out of the iris, but it had not given him any pain. A week later the same man was operated on the other eye, the cocaine this time being omitted. He pressed and squeezed it in such a way that he rendered the operation quite difficult, as Dr. v. Reuss told me afterward.

Even if the majority of patients that have to undergo such operations are torpid, persons who patiently bear their pain, yet the last case seems to demonstrate that also in such cases an anæsthetic may be of great service.

Since the publication of Dr. Koller's paper, cocaine has been extensively employed by all the most eminent ophthalmologists, as well as by the lesser lights, and all unite in lauding its great value. The following reports will sufficiently indicate its range of application in this branch of practice.

EXPERIMENTS WITH COCAINE IN THE EYE.*

In my first experiments with a two-per-cent. solution upon patients during various operations, I noticed no dilatation of the pupil, but trying it afterward on a patient with ocular neuralgia, and watching it longer, the mydriatic effect of the drug was manifest. The same with another patient in whom I slit a canaliculus and opened the distended lachrymal sac. Relying on Dr. Noyes' assertions and my previous observations—I had at that time not read the contradicting statements of Hager—I suspected that I had contaminated my supply of cocaine with atropine by using a dropper which had been taken from a bottle formerly containing duboisine, though I had carefully cleansed the dropper and used it in six instances without noticing mydriasis. I procured fresh supplies of cocaine in new glasses, provided with new droppers that had never been used. This I used upon myself and four members of my family, watching it a whole afternoon and evening. The mydriatic effect of cocaine of a two-per-cent. as well as a four-per-cent. solution was positive and pronounced in all. These *experiments upon myself and four other healthy persons* need not be described in *extenso*. The following may suffice.

The instillation of a two or four-per-cent. solution of hydrochlorate of cocaine into healthy eyes *produces no pain, nor any discomfort*. During and after its action the conjunctiva does not change its aspect; it is neither swollen nor congested. The appearance of the fundus oculi, examined ophthalmoscopically, likewise remains unchanged. The same holds with regard to the movements of the eye-ball. If there is any change in the *tension* of the globe, of which I could not positively convince myself, it is rather toward a diminution than toward an increase.

The *diminution of sensibility* in the cornea and conjunctiva varies in degree in different individuals. In most cases it becomes manifest as early as three minutes after the first instillation, increases for ten to twenty minutes, then decreases, and is over in about half an hour. When another instillation is made, from ten to twenty minutes after the first, the anæsthesia is more intense, on superficial touching mostly absolute, and lasts longer. In an hour after the first instillation it becomes very feeble, and in an hour and a half it disappears.

* Paper by Prof. H. Knapp, M. D., of New York, in the *N. Y. Med. Record*, Oct. 25, 1884.

The *pupil begins to dilate* ten to twenty minutes after the instillation, increases slowly, becomes in some persons as large as with atropia in about thirty to forty-five minutes, remains stationary for about thirty minutes, and then slowly disappears. The last trace had disappeared on the next day only.

The *range of accommodation is shortened* by moving of the near point from the eye, the far point not being appreciably influenced. The shortening of the range of accommodation was limited and differed somewhat in different observers: in myself it was equivalent to $\frac{1}{18}$ (1 D); in my son, fifteen years of age, about the same; in Mrs. K—— it was more. Cocaine, herefore, affects the accommodation like the mydriatics. It reduces, but does not paralyze it. It may, therefore, be preferable to other mydriatics if we want to dilate the pupil for ophthalmoscopic examinations of the interior of the eye, but it will probably not be powerful enough for determinations of refraction. It is a mydriatic which, even in producing a maximum dilatation of the pupil, takes away only a fraction of the power of accommodation. In Mrs. K——'s and my own eye astigmatism manifested itself very conspicuously; the letters appeared to slant from left to right; the left eye of both of us was "cocainized." With her the slanting was more perceptible in near vision, with me in the distant vision. The letter N slanted about fifteen degrees to the right, and was turned straight by a $+\frac{1}{2}$ c. ax. 110° , also by a $-\frac{1}{2}$ c. ax. 15° or 20° , the same with a $+\frac{1}{4}$ c. 110° \odot $-\frac{1}{4}$ c. 20° .

The accommodative power was restored much sooner than the normal size of the pupil. In one and one-fourth or one and one-half hour we could read again as easily as before, though our pupils were still considerably enlarged.

Cauterization of a "cocainized" conjunctiva.—The conjunctiva of my right eye was a little congested, and at 10:30 p. m., while writing this communication, I dropped a drop of a four-per-cent. solution of hydrochlorate of cocaine on the inner surface of the lower lid. Fifteen minutes later I noticed that this inner surface had become pale, paler than that of the left eye, which had been the paler before. I dropped another drop in, holding my head back so that the whole conjunctiva was moistened by it. Then I painted, before a looking-glass, a good-sized camel's-hair brushful of a two-per-cent. solution (gr. x. ad $\frac{3}{4}$ j) nitrate of silver into the eye, the lower lid being everted. I left the liquid in place about twenty seconds, then it began slightly to smart, whereas, immediately after the application I only felt the cold, no pain. I washed the nitrate of silver away with ordinary water, and put another drop of cocaine in. This relieved the smart for five minutes, then it returned, but very slightly; a serous liquid run from my right nostril, just as it does when a stronger solution of nitrate of silver is put in the eye in the ordinary way. I instilled another drop of cocaine and continued writing. In a quarter of an hour the eye felt hot and somewhat painful. The conjunctiva of the lower lid was moderately, that of the adjacent scleral conjunctiva slightly red, and along the whole lower fornix lay a white streak of mucus. The cornea and upper scleral and palpebral conjunctiva were white as if nothing had been done. The pupil was wide, and the accommodation somewhat weakened, not so much so as to make writing unpleasant, though the other eye had been "cocainized" in the afternoon of the same day.

APPLICATION OF COCAINE IN DISEASES OF THE EYE,

Case 1.—A young lady, suffering from convergent strabismus, had, October 15, 1884, two drops of a two-per-cent. solution of hydrochlorate of cocaine dropped into her eye at 4 p. m., before the students of the New York Ophthalmic and Aural Institute. Three minutes later the sensibility of the cornea, tested with tissue paper and blunt probes, was unmistakably diminished. Ten minutes after the first application, when the sensibility of the cornea and conjunctiva was greatly reduced, but not abolished, two drops more were instilled. Five minutes later the anæsthesia was complete, when the cornea and conjunctiva

were gently touched, but not when the squint hook was passed high under the upper lid. Twenty minutes after the first instillation the wire speculum was inserted, the conjunctiva grasped with forceps, cut with scissors, the hook introduced, the tendon divided with scissors, and the conjunctival wound closed with a suture. All this was felt as pain by the patient, yet not very keenly. The sensibility was not abolished, but appeared blunted.

Case II.—October 16, 1884: I instilled two drops of the above solution into the eye of a lady who had a cinder in the centre of the cornea. In ten minutes the cornea was anæsthetic. I removed the cinder by means of a delicate gouge, with very little, yet not without pain. The removal was easy.

Case III.—October 16th: The same solution instilled into the eye of a man having a pterygium. Ten minutes later, instillation repeated. The cornea and conjunctiva became insensible. During the operation—transplantation into the lower fornix and covering the defect with the adjacent conjunctiva by a stitch—the patient manifested about as much pain as this operation usually causes when performed without an anæsthetic.

The anæsthesia in these three cases disappeared almost immediately after the operation.

Seeing that the effect of the new anæsthetic in these operations had not come up to my expectation, nor to what was claimed for it, I asked Dr. E. R. Squibb whether he could furnish me a two-per-cent. solution of the remedy. He sent me a four-per-cent. solution, remarking in a letter that the two-per-cent. solution had been extensively tried by Dr. C. S. Bull, and proved only partially satisfactory. He had prepared for Dr. Bull, at his suggestion, a four-per-cent. solution.

Case IV.—Of this solution I instilled, on October 17th, at the New York Ophthalmic and Aural Institute, in the presence of the students, a few drops into the eye of a cataract patient, aged sixty-eight. In twenty-five minutes, during which time he had held his eyes closed, there was complete anæsthesia of the cornea and conjunctiva. I instilled a few drops more. Five minutes later I performed the extraction of cataract in the usual manner, asking the patient at every step whether he felt any pain. Only when the iris was drawn out and cut he said that it hurt him. The corneal section gave him no pain. The expulsion of the lens, which was done by pressure with a spoon on the lower segment of the cornea, required more force than usual, though the section was perfectly sufficient and the capsule not thickened. The eye appeared inelastic, so that the expulsive force requisite had to be imparted by outward pressure. The cleansing of the wound, the stroking back of the iris out of the cornea, and the adjustment of the flap with a spatula were not felt at all. When the bandage was applied the parts were still insensible, but free from all irritation. The patient had felt no pain, except when the iris was seized and cut; he laughed during the whole performance, and when it was finished he exclaimed: "What! is that all? I have scarcely felt anything." He had some pain in the first thirty-six hours, but no inflammatory irritation.

Case V.—October 18th: Mr. B—, aged thirty. Cinder in cornea, surrounded by a white ring, circumcorneal injection marked; since yesterday. Three drops of four-per-cent. solution. Removal twenty minutes later. Cornea insensible. The digging and scraping caused no rolling of the ball, no winking of the lids, no pain. Even when I held only the lower lid down, and left the upper free, the manipulation caused no closure of the lids.

Cases VI. and VII.—October 18th: Old *trachoma*. Insensibility of cornea and conjunctiva; touched with sulphate of copper. No pain, no irritation, scarcely any increased congestion after the application. No discomfort as when touched before.

Case VIII.—October 18th: *Polypt auris* after removal of exostosis; very painful. The sensibility in scraping them out was decidedly diminished in the superficial layers, not in the depth after two instillations of cocaine.

Case IX.—October 19th: Mrs. N—, aged fifty-six. Conjunctivitis of both eyes, *tumor*

sacci lacrymalis of the left. Four-per-cent. cocaine, six drops in conjunctival sac and on lachrymal points; ten minutes later cornea and conjunctiva anæsthetic, pupil slightly dilated. Tension of globe the same. The introduction of Weber's knife through one-half of the canaliculus is not felt, the pushing forward into the sac and slitting the inner wall of the sac, and passing a thick probe into the nose, are felt painful, but it seems less than usual.

MURIATE OF COCAINE AS A LOCAL ANÆSTHETIC TO THE CORNEA.*

Perhaps the most notable thing which was presented to the recent Ophthalmological Congress in Heidelberg, Germany, was the exhibition to the Congress upon one of the patients of the Heidelberg Eye Clinic, of the extraordinary anæsthetic power which a two-per-cent. solution of muriate of cocaine has upon the cornea and conjunctiva when it is dropped into the eye. Two drops of the solution were dropped into the eye of the patient at the first experiment, and after an interval of ten minutes it was evident that the sensitiveness of the surface was below the normal, then two drops more were instilled, and after waiting ten minutes longer, there was entire absence of sensibility. A probe was pressed upon the cornea until its surface was indented, it was rubbed lightly over the surface of the conjunctiva bulbi and of the conjunctiva palpebrarum. A speculum was introduced to separate the lids, and they were stretched apart to the uttermost. The conjunctiva bulbi was seized by fixation forceps and the globe moved in various directions. In all this handling the patient declared that he felt no unpleasant sensation except that the speculum stretched the lids so widely asunder as to give a little discomfort to the outer canthus. Before the experiment, his eye was shown to possess the normal sensitiveness, and the other eye, which was not experimented on, was, in this respect, perfectly normal. The solution caused no irritation of any kind, nor did it at all influence the pupil. The anæsthetic influence seemed to be complete on the surface of the eye and it lasted for about fifteen minutes, and the parts then resumed their usual condition.

The first experiment was done in the presence of Professor Arlt, Professor Becker, of the clinical staff, of Dr. Ferrer, of San Francisco, of some other physicians, and the writer. The next day the same experiment was performed on the same patient in the presence of the Congress and with the same results. This application of the muriate of cocaine is a discovery by a very young physician, or he is perhaps not yet a physician, but is pursuing his studies in Vienna, where he also lives. His name is Dr. Koller, and he gave to Dr. Brettauer, of Trieste, a vial of the solution, to be used in the presence of the Congress by Dr. Brettauer. Dr. Koller had but very recently become aware of this notable effect of cocaine, and he made but very few trials with it. These he had been lead to make from his knowledge of the entirely similar effect which it has for some years or more been shown to have over the sensibility of the vocal cords, and because of which laryngologists pencil it upon their surface to facilitate examinations.

The future which this discovery opens up in ophthalmic surgery and ophthalmic medication is obvious. The momentous value of the discovery seems likely to prove to be in eye practice of more significance than has been the discovery of anæsthesia by chloroform and ether in general surgery and medicine, because it will have therapeutic uses as well as surgical uses. It remains, however, to investigate all the characteristics of this substance, and we may yet find that there is a shadow side as well as a brilliant side in the discovery. Prof. Kühne, who in the Heidelberg Physiological Laboratory worked out the details of Boll's discovery of the visual purple of the retina, received the news of this new discovery

*Henry D. Noyes, M. D., in the Medical Record, Oct. 11, 1884.

with the liveliest interest. We may, perhaps, get from him a further investigation into its properties.

The following cases are reported by Prof. C. R. Agnew, M. D., of New York:

CASE 1.—A. E.—, aged five; a case of convergent squint. A two-per-cent. solution of the hydrochlorate of cocaine was dropped upon the surface of each eye three times, at intervals during a period of fifteen minutes, without any more irritation of the eyes than would have been caused by drops of common water. At the end of twenty-five minutes he walked into the operating-theatre, laid down upon the operating-chair, and allowed the spring speculum to be inserted between the eyelids, the scleral conjunctiva to be seized with fixation forceps and cut with scissors, and the rectus internus of the left eye to be divided without complaining or showing any signs of suffering. When we had the internus tendon upon the strabismus hook, he said we were pulling something.

CASE 2.—L. H. B.—, aged eleven; convergent squint. Solution applied as above, three times in fifteen minutes, at the end of which time he sat erect in a chair, resting his head upon the breast of an assistant, had the speculum inserted, scleral conjunctiva seized with fixation forceps, and the internal rectus divided in the usual manner, and when asked said the operation had given him no pain.

CASE 3.—Joseph McC—, aged six; convergent squint. Solution applied as above. In the delays of the clinic somewhat more than half an hour elapsed between the last instillation of the agent and the attempt to operate. The youngster seemed to be much frightened by the presence of the surgeon and students; would not submit to the proposed strabotomy, and ether had to be administered before it could be done. As his scleral conjunctiva was insensible to the contact of the fixation forceps fifteen minutes after the first instillation of the solution, it is a fair inference that the anæsthetic benumbing had passed away before he entered the operating-theatre. His nervous apprehension was so great that he would not have endured an operation even though there might have been no real pain inflicted.

CASE 4.—James McG—, aged fifty-two, was sent to the clinic with the statement that he had a lacerated wound of his left eyeball involving the sclerotic. His dread of handling and of light was so great that we could get no view of the injured organ, as every attempt to inspect it was instantly followed by blepharo-spasm. A few drops of the solution were instilled, and in a few moments the patient walked into the operating-theatre with the injured eye open and so free from irritability as to make an examination of it before the students quite easy.

CASE 5.—J., a physician, aged seventy-one, with double cataract, consulted us on October 15th. His eyes were extremely sensitive to touch. A drop of the two-per-cent. solution was dropped upon the scleral conjunctiva, and within two minutes and a half the patient permitted me to apply the end of a forefinger to the scleral conjunctiva without wincing.

The solution used in all these cases was a two-per-cent. one, made with distilled water and with Merck's crystals of the hydrochlorate of cocaine.

COCAINE IN OTOTOLOGY AND LARYNGOLOGY

In "Cocaine and Its Use in General Surgery," by H. Knapp, the author comments as follows on the use of cocaine in otology:

USE OF COCAINE IN OTOTOLOGY.

My personal experience with hydrochlorate of cocaine in aural surgery is limited, but encouraging. If I supplement it by what has been published after so short a time of trial, I may fairly ascribe to the remedy a considerable extent of useful application in this field.

Catheterization of the Eustachian tube through the nose is greatly facilitated by previously applying cocaine to the lower nasal passages and to the pharyngeal orifice of the tube. This can be done with an atomizer, or a brush, or a cotton pad at the end of a probe. The mucous membrane becomes insensible and thin; the catheter glides over the parts without pain, and is introduced more readily because of the dilatation of the nasal passages. This remedy will render direct catheterization possible in certain cases, in which otherwise it could only be effected through the mouth or the nostril of the other side. Whether these methods are so efficient as the introduction of the catheter through the nostril of the same side, I know not, but I do know that changing the classical bend of the catheter by making it straighter in order to pass it through a narrow or crooked nasal passage, renders catheterizations, both for purposes of inflation and injection, proportionately inefficient. It would be too troublesome had we to apply cocaine often in the same case; fortunately this is not necessary, for when the remedy has helped the patient over the discomfort of the first trials, the repeated introduction and treatment have made the manipulation easy.

Injections of cocaine into the Eustachian tube will, by their contracting influence on the blood-vessels, dilate the calibre of the canal, facilitate inflation and injection of liquids into the tube and the tympanic cavity.

It may be of advantage—though I am not aware that it has ever been tried—to inject one or several drops of cocaine, warm, through the E. tube into the drum cavity for severe earache of inflammatory origin. It might also be injected through the drumhead with a hypodermic syringe.

Instillation of cocaine into the external ear-canal in cases of *neuralgic earache* have been found useful by Roosa and Da Costa.

On the benefit derived from *inflammatory earache*, Dr. F. P. Kinnicutt writes me as follows:

I have very lately used a four-per-cent. watery solution in three cases of acute "earache" in children.

By means of a speculum and "dropper," I have applied one or two minims directly to

the drum membrane, in each case with immediate and complete relief; there was no recurrence of the pain.

In *tinnitus aurium* I have not found any improvement from instillations of cocaine, though I have made them repeatedly.

In all conditions that require manipulation, or the application of remedies, or incision, scraping, torsion, avulsion, écrasement, etc., in the tympanic cavity, when the drumhead is perforated, or in ulcers of the ear-canal and the auricle, local anæsthesia can be easily and satisfactorily effected by instillation of hydrochlorate of cocaine. The tissue-contracting and hæmostatic effect of the drug will greatly add to its value in all operations on the middle ear. These operations are particularly difficult on account of the narrowness of the ear canal and its obstruction by the slightest hæmorrhage. In prolonged operations—for instance, the removal of multiple polypi—the instillation should be continued during the operation. I have derived great advantage from this procedure in several operations.

Also in cases of *acute purulent otitis*, accompanied by intense pain, where the tenderness of the swollen walls of the meatus made cleansing both by syringing and the dry method excessively distressing to the patient, have I noticed great benefit from cocaine instillations. The manipulations were made easy, the cleansing could be thoroughly done, and the application of remedies—boric acid and weak solutions of corrosive sublimate—caused no annoyance. This treatment, because of its painlessness, was regularly carried out, and the recovery was smooth and speedy.

The application of painful remedies in cases of *chronic purulent otitis*—for instance, nitrate of silver, alcohol, etc.—can be done, after cocainization, with great or entire relief from pain.

The analgesic effect of cocaine has been noticed by J. Bettman, other aurists, and myself, in cases of *earache* when the *perforation* of the drumhead gives the remedy access to the middle ear.

Dr. C. S. Bull reports that he has performed *perforation of the membrana tympani* in three cases with entire absence of pain. In my experience of instillation of cocaine upon the healthy or inflamed non-perforated drumhead, it did not diminish its sensitiveness to the touch of a probe, and an incision in these cases could not have been painless.

Operations on the *walls of the ear-canal, the auricle, and its surroundings*, such as removal of tumors, incisions into the skin, etc., can be rendered painless by subcutaneous injections of cocaine, if the transient freezing with ether or rhigolene spray is not preferred. A few days ago I enucleated a cystic tumor, the size of a cherry, from the posterior surface of the lobule. The lobule and the tumor were held between the branches of an eye-lid clamp. Two drops of a three-per-cent. solution of cocaine were injected under the posterior side of the tumor, and two under the anterior. The tumor was shelled out entirely without pain and without loss of blood.

HYDROCHLORATE OF COCAINE IN LARYNGEAL PHTHISIS.*

All who have had any experience in battling with that most dreadful symptom of advanced laryngeal phthisis—the terrible dysphagia—will welcome any means which promises to overcome it, and give even temporary relief to the patient. Such a means I believe we have in the much-lauded cocaine, and I desire to place the results of my experience upon record, both for the sake of the sufferers and in order that the profession may be made aware of the possibilities which are at their command.

It is unnecessary in this short notice to detail my trials of this remedy. In a large series of cases the results have always been the same. One case, as an illustration, will

* Geo. M. Lefferts, A. M., M. D., in *Med. News*, Nov. 24, 1884.

answer my purpose. In a patient, the victim of advanced pulmonary and laryngeal phthisis, demonstrated to my class at the College of Physicians and Surgeons, on Tuesday last, one in whom the act of deglutition had been an absolute impossibility for one week on account of the acute pain that it caused, together with the immediate reflex spasm and rejection of the smallest amount of fluid nourishment on any attempt at swallowing, so that the patient was slowly perishing, in reality, more from hunger and thirst than from his disease, one application of the cocaine so anæstheticized the acute sensibility that a full glass of milk was immediately drank before the class with ease and entire comfort. Each subsequent application in his case, as well as in many others equally well marked, has produced the same result, and, I may add, has notably relieved the element of dyspnœa, dependent upon the engorgement and swelling of the tissues, with consequent laryngeal stenosis, probably by producing temporary tetanic muscular contraction in the fibres in contact with or surrounding the dilated bloodvessels.

One such example alone, however, is calculated to excite our warmest enthusiasm for a remedy which is capable of alleviating such a grade of human misery.

The application of the cocaine (a four-per-cent solution) was preceded in each case by a thorough cleansing of the mucous surfaces and all ulcerated points of the larynx from thick, tenacious muco-purulent discharges by the spray-application of an alkaline solution (Dobell); the parts were then immediately bathed gently, yet thoroughly, by means of a large laryngeal brush fully charged with the cocaine solution. One such application answers the desired purpose.

ON THE ANÆSTHETIC USE OF THE HYDROCHLORATE OF COCAINE UPON PARTS OF THE BODY OTHER THAN THE EYE.*

The discovery of a local anæsthetic, innocuous and easily handled, would be of such inestimable value that I have eagerly attempted to make use of the now well-known anæsthetic properties of weak solutions of the hydrochlorate of cocaine, in a variety of dissimilar cases, with the following results:

CASE I. *Diphtheria*.—December 2, 1884, R. P., female, age 19. Has been ill for three days with a well-marked case of diphtheria. The cervical glands on both sides are enlarged, and the tonsils meet in the middle of the fauces, with a large œdematous uvula elevated and pushed forwards between them. These latter structures are covered with a thick, pultaceous mass of false membrane. The whole pharynx is hidden from view. The pain on swallowing is so great that she has taken but little milk within the past twenty-four hours, and she complains of the severe pain occasioned by the constant effort at hawking.

I applied a four-per-cent. solution of hydrochlorate of cocaine, prepared for me by Mr. R. McNeil, apothecary, in a cold saturated solution of salicylic acid, as suggested by Dr. Squibb in his recent article in the *Ephemeris*. The application was made three times, at intervals of two minutes, and five minutes after the last application she drank a glassful of milk without any pain, holding the nose to prevent regurgitation, and cleared the throat of mucus with great relief.

The subsequent rapid improvement left no room for further trial of the drug.

CASE II. *Laryngeal Phthisis*.—December 4, 1884, Mrs. P., age 29. Has advanced pulmonary phthisis and extensive ulceration of the larynx, particularly the left vocal cord. She cannot swallow on account of the severe pain it gives her. She often sits a half hour trying to get a few spoonfuls of milk down.

I made two applications of an *eight*-per-cent. solution, at an interval of two minutes, to the larynx, by means of a brush, and in six minutes she swallowed a glassful of milk with

*Howard A. Kelly, M.D., in Med. News, Dec. 27, 1884.

ease. After the effects of the drug had passed off she suffered "tortures" with her larynx all night.

December 5th, condition the same as to inability to take food. I made three applications of a four-per-cent. solution, at intervals of two minutes, and six minutes after the last she swallowed without pain, but, whether from the want of sensibility or the extensive ulceration, some milk passed into the trachea and occasioned violent cough.

A two-per-cent. solution is now in the patient's hands, and her husband makes the application whenever she wishes to take food, and without any disagreeable consequences, immediate or remote.

CASE III. *Dysphagia from Phthisical Pharyngitis*.—December 5th, G. B., age 40. Has advanced phthisis. He is utterly unable to swallow on account of the severe pain it gives him in tongue and throat. The tongue is beefy-red and absolutely clean; the fauces are pale and mapped out into irregular areas by large red vessels. The pharynx is red and injected. A four-per-cent. solution of cocaine was applied as above, and he drank immediately a glassful of milk absolutely without pain.

CASE IV. *Tumor of Gum*.—December 5th, Mrs. H. came to my office and exhibits a mouth full of stumps and broken teeth fouled by incrustation at the roots.

From the left upper alveolus, about the position of the canine, depends a fleshy tumor as large as a shell-bark, vascular and ulcerated. It prevents closure of the mouth within half an inch, and of course interferes with mastication. It is painful when touched near the base with a pin. I brushed it over twice with an eight-per-cent. solution of cocaine at an interval of two minutes, and then burned the mass off with my Paquelin cautery without giving any pain.

CASE V. *Dry Pharyngeal Catarrh*.—Dec. 5th, Miss M., age 22. Every night and often through the day, the left side of the nose becomes so stopped up that her voice, which she uses much in singing, has a strong, nasal twang, and the stuffed-up feeling in the head is almost unbearable.

By the nasal speculum the left inferior turbinated bone is seen, pink and puffed out, pressing against the septum. Her condition has improved remarkably under linear applications of the nitrate of silver stick at two sittings, but the treatment was very painful, and, after the first sitting, she sneezed all the way home, a distance of two miles. At the third sitting, I brushed the surface with the eight-per-cent. solution of cocaine, repeated twice at an interval of two minutes, and in seven minutes applied the silver stick without the slightest sensation of pain and much more satisfactorily than before, when it was necessary to be very quick.

Lachrymation was as marked as usual on the side to which application was made.

From these cases, and some experiments made upon myself, some suggestions may be drawn as to the class of cases to which the drug is best adapted and the method of using it. I find, by experiment on my tongue with the eight-per-cent. solution, that two applications, at an interval of two minutes, are much more effectual than one, as to anæsthetic effect, although the duration of complete anæsthesia is not longer, being but three minutes. I find—and it is a point of the greatest practical utility—that once brought under the influence of the drug, the response is very quick to subsequent applications. For instance, the tip of my tongue was anæsthetized, and about fifteen minutes after, on applying some of the solution continuously by means of saturated blotting-paper to the back of the tongue, a little solution running down completely anæsthetized the former spot in one minute.

I was able, by continuous application of the pledgets of cotton to the prepuce outside and inside, to pass a needle through it without pain, suggesting the possibility of operating for phimosis under the influence of the drug.

By continuous application of the eight-per-cent. solution to the dorsum of my hand I was enabled to pass a needle through the skin without pain, suggesting its use in removal of

small tumors, warts cysts, etc. An application to the lip has no effect, unless the part is kept *moist*, when the physiological effect of the drug is promptly developed.

The removal of urethral caruncle and condylomata ought now to be matters of great simplicity.

A remarkable effect which I just observed on the erectile tissues of the nose, to be detailed hereafter, suggests great possibilities for this drug in hay fever by topical application to the nose and inhalation through the atomizer.

My experience thus far would suggest the following as most important deductions to guide us in its future use in operative procedure: The conditions must be made as nearly as possible to resemble those obtained in the eye, the part must be continually *bathed* in the in the solution.

For this reason operation in any natural cul-de-sac, as the vagina, ought to offer the greatest facilities. When used on mucous membranes where secretion is free, repeated applications are necessary; when used on the skin or lips or anal orifice, the part must be continuously soaked in the solution. An application of the eight-per-cent. solution to my lip dried without any effect, becoming effective as soon as moisture was supplied.

HYDROCHLORATE OF COCAINE IN AURAL AND OTHER CASES.*

On November 3d, 1884, I was requested to call on Dr. L. R. K. and remove a piece of cinder that had been imbedded in the cornea. I found on examination that the cinder was firmly fixed in the cornea and surrounded by an area of discoloration. Efforts at extraction provoked intense suffering, and I determined to use cocaine, to test its anæsthetic virtues. I obtained a weak solution from Dr. L. W. Fox, and dropped four drops every three minutes into the eye, using sixteen drops. In a few minutes the pupil dilated and the cornea was insensible. I removed the foreign body without causing the slightest pain. The cornea continued anæsthetized for nearly two days; the pupil remained dilated for a day longer, but gradually returned to the normal. Accommodation was not interfered with to any extent, J. No. 1 being read by the aid of the patient's ordinary glasses at ten inches. A curious symptom observed was a marked dryness of the throat and mouth, which passed off in the course of a day.

Since then I have used the cocaine in other eye cases. In a case of ulceration of the cornea accompanied with severe pain, the instillation of the cocaine was followed by a marked relief of all pain and a diminution of the attendant conjunctival injection. The photophobia present was not influenced by the cocaine; severe suffering was produced by exposure to light; but the constant pain attendant on the ulcer was relieved. The next day I tapped the anterior chamber, and the patient is now well.

About the middle of last month a child was brought to my office for ear trouble. The history revealed an attack of scarlet fever two years ago, followed by deafness and a discharge from the meatus. An examination proved marked loss of hearing, but I could not determine anything more, the slightest contact with the ear producing pain and exciting the girl so much that the mother interfered. I ascertained that discharges of blood occurred from time to time, and that at first, when the child held her nose and mouth and expired, a hissing noise in the ear could be heard. I obtained the child's consent to an examination if it could be done painlessly, and forthwith used a strong solution of cocaine (eight-per-cent. solution), dropping about thirty drops of this into the ear in the course of half an hour, although much of the fluid overflowed the meatus. Ten minutes after the last drops were used I opened the meatus with a small bivalve ear-speculum and found it contracted by a growth—which partly filled the canal—of a pale-reddish color, bleeding slightly upon touch. The

* H. C. Boenning, M.D., in *Phila. Med. Times*, Jan. 10, 1885.

child (Mabel C. L.) felt the manipulation, but no pain was produced. Forcible expiration produced a hissing sound, and my diagnosis—vascular polypus with perforation of the membrana tympani and chronic catarrh—was confirmed. The next day the patient appeared for operation, and after using the cocaine again (although the parts were still numb) I removed the growth and washed out the ear, no pain of any consequence being caused. The case is progressing excellently, and I hope to soon close the perforation, which is near the lower portion of the membrane, being a circular hole with thickened edges.

My own child—a boy 26 months old—a week ago developed a small follicular abscess of the meatus auditorius, accompanied by pain, feverishness, and wakefulness. I used the cocaine in his case twice in twenty-four hours with much relief. The next day I opened the abscess, which, of course, permanently relieved him.

November 5th, Mr. Barcus, a student of medicine, kindly permitted me to drop some cocaine solution into his ear, the result being similar to the above cases. The canal was benumbed. A probe and speculum, which in the other ear caused pain when twisted or moved from side to side, was felt in the anæsthetized ear, but no pain was caused.

I would note, in no case were any unpleasant symptoms produced except in that of Dr. K., where dryness of the throat was marked. This may, of course, have been a mere coincidence. In ear cases the solution should be much stronger than in eye cases, otherwise the effect will be neither so prompt nor so satisfactory.

COCAINE IN CHRONIC AFFECTIONS OF THE LARYNX AND PHARYNX.*

During a recent visit to Vienna, I had daily opportunity of watching the effects of the drug from its first introduction at Prof. Schroetter's clinic, where, indeed, all the experiments have been carried on, Dr. Jelinek being an assistant of the Professor's, and I consider that the success attending the experiments has been on the whole complete, for I can testify to the ease with which polypi and papillomata were removed from the larynges of patients who had had no previous treatment. What a contrast to the tedious method we had hitherto to adopt in order that the larynx may be tolerant of the instrument we wished to use?

Dr. Jelinek advises a ten-per-cent. solution in ordinary cases, and a twenty-per-cent. solution when the full effects of the drug are required, as in operative treatment. For Pharyngeal purposes, it is well that it should be used by means of a small swab made of absorbent cotton wool, while for the larynx a thick soft brush is preferable, using the laryngeal mirror to guide the application of the brush. The solution is to be freely applied to the *whole* of the mucous membrane, and its effects will be noticed in about a minute or a minute and a half. It is well afterward to test the state of the membrane, either with a probe or a laryngeal sound, and if the local anæsthesia is not found complete, to make another application, and as a rule after the lapse of one minute the membrane will be sufficiently anæsthetized to allow one to commence the operation. The effects last from about ten to fifteen minutes. It has been observed, and it is worth noticing, that if, by a too free application we excite an excessive flow of saliva, the latter interferes with the active principle of the drug, and so we are liable to disappointment unless we apply it with care. And again, an alcoholic solution should not be used when we have to deal with an inflamed surface, for alcohol under such circumstances becomes an irritant, and so modifies the analgesic action. For endolaryngeal operations the twenty-per-cent. alcoholic solution is used, and the formula of the solution which is applied at Vienna is: Cocaine mur., one gram; sp. vini rect., two grams; aq. distill., three grams.

The following cases will illustrate the use of the drug:

* Dr. Christopher J. Lewis, in the *Birmingham Medical Review*.

A boy, seven years old, was admitted into Prof. Schroetter's wards suffering from aphonia and dyspnœa. On examination it was found that he had multiple papilloma of the larynx. Cocaine was applied, and the professor was able to remove with ease the greater part of the growths, without exciting spasm of the glottis. One or two applications were made, and the result was that at the end of a week not a trace could be found upon the ventricles and cords of the multiple papilloma which had produced the aphonia, and the boy had fairly recovered his voice, so much so that the whisper was replaced by a good note.

A man, aged forty-five, was complaining of distressing dysphagia. For two months he had existed on "sour milk," and this he could only drink in small quantities. Emaciated and almost worn out with constant pain, cocaine was applied to the lingual and laryngeal surface of the swollen and infiltrated epiglottis, and the relief was most marked. In a few minutes he was able to drink a good draught of water, and for the first time for two months to take a little solid food.

I had an opportunity a few days ago of trying the effect cocaine has upon a painful ulcerated throat, of septic origin. I was suffering from this form of sore throat, and had the greatest difficulty in swallowing liquids. The swallowing of saliva was at one time little short of agony, and, finding no relief from the usual remedies, I had a ten-per-cent. watery solution brushed into my throat the last thing at night. I was soon relieved from pain, and in the morning I was able to take solid food with comparative ease.

To sum up, the uses of cocaine are:

1. To facilitate the use of the laryngoscope and rhinoscope, and so to aid diagnosis.
 2. To ease pain and reduce swelling in acute affections of the pharynx and larynx.
 3. To relieve the dysphagia due to tubercular perichondritis, or where due to ulceration, from whatever cause, of the posterior laryngeal wall.
 4. To anesthetize the larynx for the performance of all endo-laryngeal operations.
- I may have something to record later on of its use in some of the acute affections of the ear.

THE USE OF COCAINE IN DYSPHAGIA.

The following striking example of the successful use of cocaine in overcoming painful deglutition was related by Dr. Jelinek in a paper read before the Vienna Society of Physicians, which has been published in full in the *Wiener Medicinische Wochenschrift* (No. 46). The patient, a male aged forty-five, was suffering from tubercle. There was extensive swelling, and brawny infiltration of the epiglottis, but only moderate dullness and slight crepitation were discoverable at the apex of the right lung. He had been treated as an out-patient in the clinic of laryngology for three months, and iodoform and morphia had been daily blown into his larynx and he had constantly taken ice. In spite of this treatment he affirmed that for close upon two months he had only been able to swallow milk in the minutest quantities. He was extremely wasted, incapable of work, scarcely able even to walk, and tortured by continuous pain and thirst. Before applying the cocaine solution Dr. Jelinek made him drink some water. He had hardly swallowed a drop before he started up in the greatest pain, while the water returned through his mouth and nose. Dr. Jelinek then carefully painted the lingual and part of the laryngeal surface of the epiglottis, and the valleculæ, with a ten-per-cent. solution of cocaine, and a minute afterward told the patient to drink again. The man anxiously took a small mouthful, for a moment looked around in astonishment, and then, to the surprise of all, greedily swallowed the whole glassful at a single draught. Tears of gratitude filled his eyes, and he could scarcely find words to express his thanks. The next day he related that on reaching

home, an hour after the application, he had, to the astonishment of his wife, made an excellent meal (the first he had had for two months) without any difficulty, but that soon after the pain reappeared, and three hours after the painting was as bad as ever.—*Medical Times and Gazette*.

COCAINE AS A LOCAL ANÆSTHETIC IN INTRA-LARYNGEAL OPERATIONS.

Felix Semon, M.D., M.R.C.P.Lond., Assistant Physician in charge of the Throat Department of St. Thomas' Hospital, says: Cocaine has lately been highly recommended as a local anæsthetic in operations upon the eye and throat. Having on my first trial of this new remedy for operations upon the larynx met with very signal success, I think it my duty to record the fact at once for the benefit of others.

I have under my care at the present time a lady with the largest papillomata of the larynx I have ever seen in an adult. The prolonged interference with respiration has so lowered the patient's vitality that on each of the seven occasions on which I have removed masses of the growth by forceps, the mere introduction of the instrument has caused alarming shock. Recently I painted the interior of her larynx with a twenty-per.cent. solution of muriate of cocaine once, and after waiting five minutes I was able to introduce the forceps four times and remove each time considerable portions of the tumors without the patient experiencing any pain at the moment or subsequent shock. She described the sensations caused by the cocaine as, first, a slight feeling of constriction, followed by a sensation of burning, which quickly passed away.—*London Lancet*.

COCAINE IN GYNÆCOLOGY.

COCAINE IN DYSMENORRHŒA.*

Having employed the new anæsthetic, cocaine, with the happiest results, in a case of dysmenorrhœa, I thought it might be of interest to publish the facts.

My patient has suffered for years from painful menstruation, accompanying a retroflexion of the uterus, complicated with adhesions. The deformity of the uterus has been rectified by treatment, but the pain during the menstrual period is still as agonizing as ever. The most acute and intolerable anguish is felt in the left inguinal region, and is accompanied by a wind colic that causes the sufferer to writhe in agony. Nausea and vomiting add to her distress, and she seems at times ready to go out of her mind with suffering.

While still hoping to effect a permanent cure of this condition by appropriate treatment, temporary relief by the administration of morphia is all that I have hitherto been able to afford her; at the same time, that drug produces such disagreeable effects, that the remedy is only not quite so bad as the disease. It excites the nervous system, banishes sleep, it adds to the nausea, increases the prostration, destroys the appetite, and fails to keep off the wind colic. But on the last occasion, instead of morphia, I used cocaine, injecting subcutaneously over the left ovary, at first three, increased afterwards to five minims of a four-per-cent. solution. Almost immediately after each injection the pain in the inguinal region ceased to be felt, the nausea and wind colic were relieved, and, instead of nervous excitement and wakefulness, a soothing effect inclining to sleep was experienced. Five minims of a four-per cent. solution were sufficient to afford complete relief for five or six hours, and comparative immunity for a much longer period.

While, however, the drug acted thus admirably, both locally and generally, it had no effect, apparently, on the bearing-down pains, and pain in the back, but only upon the local pain in the neighborhood of the spot where it was injected. It was also noticed, that, while it relieved the nausea and vomiting of a reflex origin, it sometimes caused slight nausea itself, but this was only temporary. No other unpleasant effect was experienced, if we except a slightly bitter taste imparted to the tongue.

If cocaine can thus be made to supercede morphia in such cases, it will certainly prove an inestimable boon to many an unfortunate sufferer. And if it is able to relieve that excruciating intestinal pain usually called wind colic, which in so many cases is sure to follow the slightest surgical interference with the uterus, this of itself will be no mean trophy added to its many wonderful triumphs over human suffering.

* John Forrest, M. D., in Medical News, Jan. 10, 1885.

MURIATE OF COCAINE IN LABOR.*

For some years I have been in the habit of using dilute solutions and ointments of carbolic acid, both as disinfectants during examinations and to mitigate the pains of labor, but lately have thought that local anæsthesia can be more thoroughly induced by the employment of muriate of cocaine, either in solution alone or associated with dilute carbolic acid. A few days ago I had an opportunity of testing it upon a multipara, during the birth of her seventh child; and, though the quantity of two per cent. solution employed was small, and the difficulties of keeping it *in situ*, owing to discharges, great, yet the results were satisfactory enough to encourage us to give it further clinical trial.

The case was not seen until the neck of the uterus was well dilated, nor was any of the drug purposely applied to the os, but at each examination after the discharge of the amniotic fluid, a few drops of the watery solution were smeared by the index-finger around the labia and vagina, producing anæsthesia in spots, but more on the anterior than the posterior portions, probably because the drug in this situation, with the patient on her back, was not so readily washed away.

The uterine pains did not seem to be interfered with, but owing to anæsthesia of the vaginal walls, the voluntary straining efforts of the patient were not so prolonged as they had been in the other labor in which I had attended her, nor was the last pain severe enough to make her cry. Had the case been seen earlier, and the drug been used of greater strength and more freely, or been applied in such a manner as to prevent its being washed away by the discharges, a still better result would no doubt have been produced. As it was the case ended rapidly and very satisfactorily to both mother and child, and the former did not suffer from the after-soreness, which is such a common accompaniment of ordinary labor.

MURIATE OF COCAINE AS A LOCAL APPLICATION IN VAGINISMUS.†

The next patient is married, but for some months past has suffered so severely from vaginismus that coition has been impossible. I have made no examination, but Dr. Morris has; and he states that so strong is the contraction of the vaginal sphincter it is impossible to introduce the finger into the vagina without difficulty and causing severe pain. He is desirous of trying the effect of the new local anæsthetic, the muriate of cocaine. As this remedy has been so successfully used in other departments of the hospital, it is quite proper, nay, almost essential, that the gynæcological department should, if possible, present illustrations of its value. The doctor will now apply a four-per-cent. solution of the drug to the vaginal orifice, and while waiting its effect, which will be complete in ten minutes, a few words may be said upon the subject of this disorder.

The form of vaginismus with which you will most frequently meet is that involving the vaginal sphincter. It was very well described in a paper presented to the London Obstetrical Society several years ago by our eminent countryman, the late Dr. J. Marion Sims, though he was by no means the first to observe it and to narrate cases of the disorder.

* Dr. J. R. Uhler, in Md. Med. Journal.

† There may be a vaginismus affecting not the sphincter, but the canal itself, caused by contraction of the levator ani. I need hardly remind you of the origin and insertion of this muscle, and show you that its strong contraction will narrow the vaginal canal. Elsewhere we have recently shown that we must go back at least two centuries to find the first description of this disorder, so that upon this subject we are not so very much wiser than were physicians in the sixteenth century. In medicine we have a great deal of old coin re-issued, with a new stamp on it; or rather we frequently unconsciously rediscover, not knowing that we have simply found anew that which has been forgotten. But, not to prolong these remarks, let us return to the patient and ascertain what, if any, effect has been produced by the medicine. Dr. Morris states that the vaginismus has entirely disappeared. We may add, therefore, the application which you have seen just now to the therapeutic uses of cocaine and to the therapeutics of vaginismus.—*College and Clinical Record*, Feb. 1, 1885.

The applications of sedatives to the vulvar and vaginal canal, gradual or abrupt dilatation, division of the sphincter, and division of the so-called perineal body, are among the means that have been resorted to for its cure. I need not mention the use of anæsthetic inhalations; for example, etherizing the patient, as has been done in this country, and as is still advised by an eminent authority. Undoubtedly it will be a great gain if the muriate of cocaine accomplishes all that Dr. Morris anticipates from it.

The causes of this variety of the disease are many, such as sensitive tumors of the urethral meatus, vaginal fissures, etc., but in many cases there is no local disorder explaining the spasm, and then it is spoken of as a pure neurosis.

A CASE OF VAGINISMUS TREATED SUCCESSFULLY WITH HYDROCHLORATE OF COCAINE.

Dr. Dujardin-Beaumetz reports (*Bulletin Général de Thérapeutique*) the case of a servant thirty-three years of age, who was married at the age of twenty-one, had a child eighteen months later, with a tedious labor which required the use of the forceps. For several months after her confinement she suffered from the effects of a partial retention of the placenta. Upon recovery, sexual congress became extremely painful, which was so marked that all cohabitation was impossible. Upon admission to hospital and examination, some distance from the orifice of the vagina there was found to be a contractile adhesion strongly marked and resisting the passage of the finger. While the patient was under chloroform the vaginal orifice was forcibly dilated, first with the finger and then with the speculum. This operation not proving very satisfactory, a gradual dilatation was attempted by the introduction of the bivalve speculum twice daily, and left in place for one or two hours at a time. This treatment proving as ineffacious as the first, painting the internal surface of the labia minora and the whole circumference of the vaginal orifice with a solution of cocaine, 2 parts per 100, was practiced. In about a minute sensibility to the prick of a needle had disappeared, and the speculum was introduced almost without pain, much to the surprise of the patient. A second application made on the following day gave the same result. On the third day the speculum was introduced without the use of the drug. —*Jour. Am. Med. Asso.*, February 2, 1885.

MURIATE OF COCAINE IN OPERATIVE GYNÆCOLOGY—VESICO-VAGINAL FISTULA.*

Dr. W. H. Doughty, Jr., of Augusta, Ga., writes: The peculiar interest which attaches to all reports upon the use of the hydrochlorate of cocaine leads me to report the following observations, made November 18, 1884, upon its effects during an operation for vesico-vaginal fistula:

The fistula was a small one, barely admitting a silver probe of ordinary size. The patient having been placed in the "knee and breast" posture, after thoroughly cleansing the vaginal surface and roughly testing its sensitiveness, two applications (two drops each) of a two per-cent. solution of the hydrochlorate of cocaine were made, three minutes apart. Two minutes later the sensitiveness was decidedly lessened, but not enough for my purpose. The solution was now freely applied with a brush, and five minutes later the application was repeated. After three minutes more the anæsthesia seemed to be complete.

The paring was made during sixteen minutes without the slightest evidence of pain, but at the expiration of this time the patient complained, and the solution was again applied. In thirteen minutes more the paring was finished without pain.

* *New York Medical Record*, Dec. 13, 1884, p. 658.

The patient having been in the "knee and breast" posture for more than a half-hour, and being now fatigued, was placed in Sims' position and allowed to rest for a few minutes. Upon resuming the operation, the introduction of the first two sutures was attended with considerable pain; the solution was, therefore, again applied, and the remaining sutures, four in number, were introduced without pain.

The apparent effect of the drug upon the hæmorrhage was worthy of note. During the first sixteen minutes of the paring there was very slight oozing, but when the sensitiveness returned the loss of blood was decidedly increased; it diminished very much after the solution was reapplied.

The sponge was not carefully used before making the application during the introduction of the sutures, and the coagula which formed were seemingly firmer than usual and rather difficult of removal by sponging.

Drs. T. R. Wright and J. M. Hull, of this city, were present and assisted me.

COCAINE IN GYNECOLOGY AND OBSTETRICS.

Under this title Prof. W. M. Polk, M. D., in *Cocaine and Its Use in Ophthalmic and General Surgery*, by H. Knapp, discusses the application of cocaine in gynecology and obstetrics as follows, viz.:

That this remedy may be of service in a number of the operations upon the female genital tract is shown by its action in the few in which it has been tried.

The results obtained in the operations upon the cervix are quite satisfactory. The normal sensitiveness of this portion of the uterus being less than that of most of the tract, we have a tissue that can be readily influenced by the drug. Consequently, trachelorrhaphy, incision of the cervix, forcible dilatation, the application of caustics or the sharp curette to the cervical surface, have all been satisfactorily performed under the influence of cocaine. Even in cases of commencing cancerous disease, we have been able to make a free application of the actual cautery, causing but trivial discomfort; the well-known danger of the general anæsthetics—even ether—in advanced cancerous cachexia making the use of this remedy in such cases peculiarly attractive. The method of application that seems best in preparing the cervix for operation, is to inject from three to five minims of a four-per-cent. solution into the regions that are to be cut, stretched, or scraped.

In all cases where, from the use of the Sims speculum, prolonged stretching of the perineum is to be endured, the whole of the posterior and lower half of the vagina should be thoroughly painted.

In operations upon the vagina we meet with more difficulty, owing to the greater sensitiveness of the tissue; still by careful injections into the region to be cut we have made satisfactory operations.

The most striking results were obtained in *small vesico-vaginal fistulæ*. Here the remedy (four minims of a four-per-cent. solution) was injected first on one side of the fistula—half an inch away—then on the other. Next the mucous membrane of the vagina and the bladder around the opening were freely painted with the solution. The tissues were then cut without discomfort. Operations for restoration of the perineum were less satisfactory, the sensitiveness of this region being perhaps more pronounced than in other regions of the tract. Our observations, however, have led us to believe that in certain cases where the lesser forms of perineal rupture are found, the remedy could be made to answer a useful purpose. Certainly, in the removal of wire stitches from the perineum, a procedure that is usually very painful, the results have been satisfactory. The best method of applying the remedy in all operations about the perineum is to inject four or five minims of a four-per-cent. solution into the two sides of the vagina, just within the ostium, and then carefully rub the same solution into the skin and pseudo-mucous membrane which covers, first the perineal

region and lower end of the labia majora, the second, the faces of the torn perineum and the inner faces of the labia; lastly, freely applying to the whole of the lower third of the posterior and lateral vaginal walls. In all of these surface applications the tissue should be carefully cleansed with soap and water and then dried.

. In the removal of urethral caruncles, bodies well-known to be more than usually sensitive, we have operated with the cautery without pain, first injecting into the tumor four minims of a four-per-cent. solution.

In like manner we have cauterized painlessly chancroids and chancres, securing the anæsthesia in such cases by merely painting over the sore some half a dozen times with the four-per-cent. solution.

In estimating the value of cocaine in gynecology, it should be understood that its field is limited. There are many women who are too sensitive, too apprehensive, to be kept quiet during a protracted operation by anything short of general anæsthesia.

In general it might be stated that in the lesser operations, and even in those that require time, when the subject is phlegmatic and endowed with self-control, cocaine will prove satisfactory.

IN OBSTETRICS.

Naturally attention was early directed to the possibilities of the remedy in obstetrics. A good article of cocaine was furnished Dr. Le Fevre, the House Physician of the Second Medical Division, Bellevue Hospital, and he was directed to try its efficacy in various stages of labor. During the first stages of labor injections of four minims of the four-per-cent. solution were made into the anterior and posterior lips, at the vaginal junction. Complete anæsthesia of the cervix was obtained for an hour, during which time the labor pains were so modified that the patients complained only of discomfort above the symphysis pubis and some dull pain over the sacrum. The cervix could be stretched freely without causing pain, so that it was quite evident that decided relief had been obtained. An effort was made to secure the same result by merely painting the solution over the cervix, but owing to the profuse mucous discharge this application was difficult and the results unsatisfactory.

To modify the pains of the second stage, injections were made into the vaginal walls along the course of distribution of the pudic nerves. In this the results were so far successful that the child's head passed out of the vagina with so little discomfort that the patient uttered no complaint. Careful observation of all the children of these cases showed no ill-effect of the remedy. When rupture of the perineum occurred, the remedy was injected into the torn surfaces and rubbed on the skin. In this way sufficient anæsthesia was obtained to permit of the easy passage of sutures for repair. During labor cocaine seems to possess no special advantages over chloroform, unless it be in those cases where this remedy is contra-indicated.

In cases requiring dilatation of the cervix, as by Barnes dilators, it may prove of great service. In one case of troublesome nausea and vomiting of pregnancy, Dr. Le Fevre found an eroded and sensitive os as the cause. Careful painting of the surface with a four-per-cent. solution of cocaine gave entire relief from the gastric disturbance. Excellent results were likewise obtained in cases of nursing women who had painful and eroded nipples. The four-per-cent. solution was freely applied to the nipples, 15 minutes before nursing, then washed off with warm water just before applying the child. In all these cases the dreadful and wearing pain was either entirely relieved, or else so modified as to be quite bearable. And here we may say that if obstetrics derive no other benefit from cocaine than this, we would have sufficient ground for hearty commendation.

COCAINE IN GENITO-URINARY SURGERY.

THE HYDROCHLORATE OF COCAINE IN GENITO-URINARY PROCEDURES.*

My attention was first attracted to the probable value of the hydrochlorate of cocaine in genito-urinary troubles by my friend Prof. C. R. Agnew, who gave me an early account of his gratifying success in operations on the eye (subsequently published), and also kindly gave me sufficient of the two-per-cent. solution to try its effect on the mucous membrane of the urinary passages. Before a suitable case presented, I received a note, November 6th, from Professor R. W. Pease, of Syracuse, giving me an account of his use in the urethra of a four-per-cent. solution in an operation for stricture an inch and a half back of the meatus on the day previous, "About twenty drops were used with a common dropper, stopping the progress of the solution backward by holding my finger on the urethra back of the stricture, and retaining it in the canal about eight minutes. The sensation was about nil. I ought to have retained it fifteen, and I think then the success would have been complete I have used the cocaine in a sensitive urethra, when catheterization was very painful, with charming results." He concludes: "I make no doubt in this new agent we have something that will entirely take the place of ether in all operations on the penile portion of the urethra." On the day following (November 7th), I dropped a few drops of the two-per-cent. solution received from Dr. Agnew into the first inch of a very sensitive urethra, holding it in ten minutes. I dilated the orifice from 27 mm. to 31 mm., preparatory to an operation for litholapaxy, which was to be done on the following day, and I did not wish to incise. The patient was very hyperæsthetic, but gave not the least evidence of pain during the operation. November 11th, Dr. Coonley, of Staten Island, called with a patient suffering agony from frequent and difficult micturition. A stone in the bladder was suspected, but the doctor said it was impossible, and that intense pain was caused by the attempted introduction of instruments to get a satisfactory examination, and the patient was averse to the use of ether. He was obliged to urinate before anything was done, and it was at least five minutes, after passing a few drachms of urine, before the vesical tenesmus was fairly over. I then injected with an ordinary penis-syringe, about fifteen drops of the solution given me by Dr. Agnew, and pressed it back into the urethra as far as possible. The patient retained it by pressure at the orifice for ten minutes. This was repeated, and at the end of the second ten minutes I introduced and passed a silver searcher (Thompson's) through the urethra (detecting a scale of calculous material *en route*) and into the bladder, without causing the least pain. I struck a stone in the bladder. I then took a large-sized Thompson's lithotrite and introduced it with some

*Prof. F. N. Otis, M. D., in *N. Y. Med. Journal*.

difficulty through the preputial orifice, which was not only contracted, but adherent to the orifice of the urethra. There were also two bands of stricture within the first inch of the canal, which impeded the progress of the lithotrite. By a little perseverance, however, I passed by these obstructions and carried the instrument into the bladder, grasped a stone of a diameter of one inch, and, while holding it, struck another stone, thus demonstrating the presence of at least two stones.

I then disengaged the lithotrite and withdrew it, tightly hugged in the anterior part of the canal. The patient stated, with great unction, that he felt not the slightest pain during the entire procedure. I then divided the preputial orifice freely, also the meatus and the strictures previously mentioned, with a straight, blunt bistoury. Not the least flinching or sign of pain was observed, and the patient stated that he felt only a slight twinge when the second stricture was cut. This was fully ten minutes after the second introduction of the cocaine.

Delighted with the success in producing perfect local anæsthesia in this case, I immediately determined to use it in a case of hyperæsthetic urethra, associated with enlarged prostate, where, on account of the intolerance of the urethra to any sort of interference, the introduction of the catheter for emptying and washing of the bladder had been entirely suspended for several weeks. I had quite used up the solution given me by Dr. Agnew, and the leading drug-stores could not furnish it. I at last succeeded in getting half an ounce of a two-per-cent. solution. The patient (who was also a professional friend) was most anxious to have it tried, and was full of hope that this would enable him to have the necessary catheterization performed. The great dread of any interference made him insist that the solution should be introduced very slowly and gradually. It was fortunate that he did so, for, when not more than three or four drops were injected into the urethra, he became almost frantic with pain, and it was only after half an hour that the intense suffering caused by the injection passed entirely off. The action of this two-per-cent. solution, presumably of the same kind as that used in the previous cases, made me fear that, as with other anæsthetics, there were idiosyncrasies in some persons that would contra-indicate its use. On making inquiry, I ascertained that there had been a number of cases met with where, a four-per-cent. solution of hydrochlorate of cocaine being used in the eye, a period of thirty or forty seconds of quite sharp irritation preceded the anæsthetic effect, and, also, that at least one case of sharp urethritis had been directly caused by its application to the urethra. On making close inquiry, I at last ascertained that the druggist from whom I obtained the solution, having none of the hydrochlorate on hand, *had dissolved the alkaloid in hydrochloric acid*, and had used this extemporaneous hydrochlorate for my solution.* Having soon the good fortune to obtain a small bottle of Merck's crystals of the hydrochlorate of cocaine, I made a two-per-cent. solution with distilled water, in which two-per-cent. of biborate of sodium had been dissolved, and on a second trial in the same case, where so much suffering was caused through the impurity of the solution, I succeeded in applying it to the urethra, as in the previous case, and in passing a catheter, drawing off the urine and washing out the bladder without the least pain. On Thursday last, November 20th, in my clinique at the College of Physicians and Surgeons, I introduced a similar solution into a very sensitive urethra associated with senile hypertrophy of the prostate. A preliminary attempt to pass a catheter caused manifest pain. After the retention of the four-per-cent. solution of hydrochlorate of cocaine for ten minutes in the urethra, the

*I subsequently tasted the cork of the phial containing the solution, and found that a sharp, stinging sensation quickly followed, and continued to be felt for ten or fifteen minutes. On applying Merck's four-per-cent. solution of cocaine to my tongue, in the same way, only a slight feeling was produced, reminding me of a weak solution of aconite.

catheter was passed through the urethra, and subsequently the bladder was examined for stone, and not the least complaint of pain in the urethra was made.

On the 23d inst. I introduced a four-per-cent. solution into a fairly tolerant urethra to a depth of four inches, and retained it ten minutes. I then divided with my dilating urethrotome a dense stricture half an inch broad and five millimeters thick without the least shrinking on the part of my patient, who stated that he had only the feeling of distension, and not the slightest sense of pain during or subsequent to the operation. I have made several experiments since, and find that the best mode of introducing the cocaine solution for relief of irritable urethræ, especially when associated with prostatic trouble, is to attach a tight-fitting-half-ounce penis-syringe to an open-end rubber catheter of eighteen or twenty mm. in circumference. After pouring the solution into a small graduate, draw a sufficient quantity up into the catheter. Introduce it for a half-inch, or until the patient complains of pain, then press down the piston, gradually driving a few drops in advance of the catheter, rubbing it along with the finger, waiting for three or five minutes, then passing it down about two inches farther, and repeating the process of coaxing the fluid back until finally the end of the catheter enters the bladder, consuming altogether about fifteen minutes.

It will, I think, be proved that the greatest good will come from the use of the cocaine in the cases of irritability of the deep urethra associated with prostatic disease. In these cases the passage of a catheter, so essential to the comfort and even the life of the patient, is frequently rendered painful, and not rarely impossible, by spasm of the deep urethra. The use of cocaine promises quickly to reduce both pain and the spasm, and allow of the easy passage of the instrument, and this, too, by a procedure quite within the province of an intelligent patient to use after proper instruction. A four-per-cent. solution of the hydrochlorate of cocaine in almond-oil makes an excellent lubricant for urethral instruments, and I think may prove even better than the watery solution for applications to the urethra. Its use in this way, in a few cases, has been very satisfactory.

The value of the solution of hydrochlorate of cocaine will be equally found in examinations of and operations upon the irritable anus and rectum. Yesterday I had occasion to examine a case of deep and irritable ulcer involving the tissues around the anus fully three inches in circumference to a depth of fully half an inch, and extending inward an inch or more beyond the margin of the external sphincter. The patient was an old woman of sixty, who had been worn to the last degree of irritability by nearly two months of suffering. After painting the surface of the ulcer with a four-per-cent. solution for ten minutes, I then introduced a bivalve speculum and exposed the whole interior surface, and cauterized it thoroughly, without the least expression of pain from the patient.

NOTES ON HYDROCHLORATE OF COCAINE—ITS POSSIBLE DERMATOLOGICAL USES.*

During the past two weeks I have employed the hydrochlorate of cocaine in four-per-cent. watery solution a great number of times, and with such manifest advantage to myself and satisfaction to my patients, that I think a word upon the subject may be not unacceptable to the society. The surface sensitiveness of the anterior urethra may be so deadened by injecting ten minims of this solution along the pendulous and into the prostatic urethra by means of a deep urethral syringe that manipulation by instruments is tolerated much better than where this agent has not been used. No appreciable effect is produced on the deep urethra, and only the surface sensitiveness seems to be blunted. Cutting or stretching strictures is still painful and irritability at the neck of the bladder not sensibly modified, yet

* Dr. E. L. Keys, in *Four. Cutaneous and General Diseases*.

a manifest advantage is obtained in the facility with which explorations may be made and cutting instruments inserted before the painful final incision is made. Meatotomy may be performed almost without pain in some cases, and in one instance I performed deep internal urethrotomy to the great delight of the patient, who had been cut in former years. He joined in applauding the new method.

Chancres and warts, I judge, may be rendered insensitive to caustic, although I have not yet personally proved the fact.

Small tumors may, however, be cut out from the skin, and subcutaneous tumors removed almost without pain.

My first case was that of a physician with a small syphilitic chancre on the dorsum of the penis. The lesion was less than two days old, but the party from whom it had been acquired had undoubted syphilis. No glands were involved and the doctor wished the sore to be removed. I injected four minims of the solution directly under the sore, washed the whole cutaneous surface in a two-and-one-half-per-cent. bichloride of mercury solution, picked up the sore and a fair amount of surrounding integument with toothed forceps, and with one cut of a scissors curved on the flat removed the sore, and the entire thickness of the skin beneath and around it. I then arrested hemorrhage, tied a small vessel, and applied three points of catgut suture. The doctor looked on smiling, and declared that although he could feel pressure he experienced not the slightest pain during all the manipulations.

My next case was the removal of a small epithelioma from the margin of the anus. I injected ten minims of the solution, five on each side of the ulcer, stretched the sphincter to a circumference of six inches with a three-bladed dilating speculum, and removed the growth. The stretching caused considerable pain, the cutting little or none, according to the patient's statement.

I have also removed warts, moles, and lipoma from physicians and patients with a uniform testimony that the pain was not worth mentioning. I have relieved mild anal pruritus at once by the application of the six-per-cent. oleate, although the effect was quite temporary. The possible advantages of this application endermically or hypodermically need only be alluded to to be appreciated.

What could be more agreeable, should it prove effective, as I believe it will, than to inject ten or more minims between the folds of the prepuce, and then cut away the prepuce and its injected fluid, and apply the sutures after circumcision without pain?

In cutting out lipomata, fibromata, wens, warts, and the like; in scraping, cauterizing, electrolyzing the skin; in tenotomy; possibly in removing inflamed glands and opening abscesses, in epilation and many similar processes it seems to me possible that a great future is open to this remedy.

What it will do when injected subcutaneously for superficial neuralgia and intense pruritus (scrotal for example) I have yet to learn.

COCAINE IN URETHRAL SURGERY.*

SIR: I send you the following cases from my note-book, with the hope that they may elicit the experience of others in the same direction.

Seminal Weakness. Nov. 25, 1884. Being desirous of faradizing the urethra of W. G., I found the introduction of the urethral electrode prevented by the extreme sensitiveness of the mucous membrane. Having the day before secured a two-per-cent. solution of the hydrochlorate of cocaine, 3ss was slowly injected and retained for a few minutes, pressure upon the under surface of the penis being made to distribute the solution. The

* Ezra A. Bartlett, M. D., in *Med. News*, Jan. 31, 1885.

electrode was then introduced, and passed, without pain, into the bladder. Having been withdrawn to the desired point, the operation was proceeded with without further trouble.

Spasm of the Sphincter Vesicae. F. R. W., Nov. 30, 1884. Introduction of the urethral electrode for faradization of the muscle was rendered impossible, as the sensitiveness of the mucous membrane just inside the meatus caused the patient intense suffering when such manipulation was attempted. The injection of a two-per-cent. solution of cocaine relieved the condition in five minutes. This patient has been seen by me several times for this same trouble, and I have heretofore relieved the sensitiveness of the urethra by the injection of a weak solution of carbolic acid in glycerine.

Chronic Cystitis. C. A. R., Dec. 20 1884. Patient has been under observation for several months, and all attempts to treat the case by internal application of galvanism have been unavailing on account of the pain attendant upon the introduction of the urethral electrode. To-day I employed 3 ss of a two-per-cent. solution of hydrochlorate of cocaine; and there being no amelioration of the sensitive condition at the expiration of fifteen minutes, I injected the same amount of a four-per-cent. solution, which I obtained by evaporating a two-per-cent. solution over a sand-bath. This produced the desired effect in a very few minutes.

Stricture of Large Calibre in Spongy Portion. H. S., Jan. 5, 1885. Whole urethral tract very sensitive. Injection of 3 ss of a two-per-cent. solution of muriate of cocaine removed the hyperæsthesia from the greater part of the urethra, but produced no amelioration at the seat of stricture. Another injection of the same solution, located as well as possible with a long-nozzle syringe at the strictured portion, failed to relieve the difficulty. The next day, 3 ss of a two per-cent. solution was injected to allay the general hyperæsthesia, followed immediately by the application of a four per-cent. solution in glycerine to the seat of the stricture by means of a canula and sponge. No relief of the sensitiveness was obtained, but the patient became extremely pale, remarked that it was growing dark, perspiration stood upon his face and hands, and in a moment more he had ejected the partially digested contents of his stomach upon the floor. He soon recovered, and felt no further disturbance.

The above cases are of interest as examples of the value of cocaine in urethral instrumentation, and the last one indicates a field of investigation as to the depth to, and the tissues upon, which this alkaloid acts. The not serious, but decidedly unpleasant, symptoms in the last case are mentioned not that cocaine necessarily bears a causal relation to them, but that they may be remembered as having occurred in conjunction with the application of a four-per-cent. glycerole immediately following the injection of a two-per-cent. solution. I have not determined the existence of an ulcer at the seat of stricture which might account for the symptoms, and I have not developed them at subsequent operations, at which times I have not applied the cocaine so freely.

COCAINE IN OPERATIONS FOR FISTULOUS CANALS.*

The following case is interesting from two points of view: 1, as indicating the risk a patient seems to run in moving from a healthy country district to town to have a surgical operation performed, however skillfully done; and (2) the great value of cocaine as a local anæsthetic, even when considerable flesh wounds have to be inflicted, in cases where it is undesirable to administer a general anæsthetic from some idiosyncrasy in the patient.

A country clergyman, whose home is situated in an open, bracing, and exceptionally healthy locality, 600 feet above the sea, was the subject of hemorrhoids, for which he was advised to place himself under the care of one of the best-known specialists for this affection.

* Dr. J. G. Barford, in the *Lancet*, June 6.

He went from the pure air of the country into a private surgical home for the purpose of having the hemorrhoids removed. No difficulty was experienced in the operation, and the inner surface of the rectum healed readily, and remains sound up to the present time. But a few days after the operation some untoward constitutional symptoms presented themselves. The temperature rose to 104° , and general febrile disturbance ensued. In a few days, pain, tenderness, and swelling displayed themselves along the perineum to the scrotum, and in due course a considerable accumulation of pus was apparent. A free incision was made, and with the discharge of pus the general symptoms improved. There was also another small accumulation of pus in the inner surface of the buttock, running up in the direction of the rectum. This, too, was freely opened. At the end of the fifth week from the operation, the patient was removed in one of Ridding's invalid carriages into the pure air of the country. His general symptoms had somewhat improved; but the discharge from the wounds was very sanious, and far from healthy-looking; he was not making the progress a patient should do under the circumstances. His condition was one of evident septic infection. Two sinuses remained at the points of suppuration, about the depth of half an ordinary surgical probe, and leading to what appeared to be soft and easily broken-down tissue, threatening to work their way towards the rectum, or it might be into the urethra. The patient's condition at this time did not justify further operative interference. At the end of two months from the operation two other sinuses were formed in the perineum between the anus and the scrotum. One of these healed spontaneously, as, indeed, the sinus occasionally does. Two of the other sinuses communicated with each other. At the end of three months from the removal of the hemorrhoids the patient's constitutional condition had sufficiently improved to justify further surgical interference, and it was decided to lay the sinuses freely open. The patient had, however, on previous occasions proved to be such a bad subject for general anæsthetics, that their administration was thought unjustifiable; I therefore decided to use cocaine to destroy the sensibility of the part. Some small plugs of cotton-wool were saturated with a twenty-per-cent. solution of cocaine, supplied by Mr. Martindale, of Cavendish street, and these were inserted into the sinuses, one plug in each, and allowed to remain for a quarter of an hour. They were then removed, and each sinus laid freely open with an ordinary bistoury and director. No pain whatever was felt by the patient in laying open two of the sinuses, the patient not knowing even when the incisions were being made. In laying the third sinus freely open a considerable portion of the skin had to be cut through, and while the bistoury was passing through the skin the patient displayed some consciousness of it. The skin is evidently not so ready an absorbent of cocaine as either the mucous membrane or an abraded surface. If I had again to use cocaine in an operation involving the skin, I should apply a little liquid blister to abrade the surface before the application of the cocaine. Exactly one drachm of the twenty-per cent. solution was used. In operations with cocaine there is but little hemorrhage, thus it is not unlikely to become a valuable remedy to restrain bleeding.

COCAINE IN CHRONIC CYSTITIS AND IRRITABLE BLADDER.*

Mr. Bellamy's note on the above in the *Lancet* of the 14th inst. determines me to send you a confirmatory observation, though used in one case only.

I have been treating a gentleman, over 68 years of age, for chronic cystitis, bladder sacculated, dependent on prostatic disease; latterly the symptoms have been much aggravated, micturition every few minutes, with intense pain at the neck of the bladder, thick muco-purulent discharge when the bladder is washed out (twice daily with boroglyceride), and diarrhœa. Almost every remedy has been used—by mouth, injections, suppositories—

* F. F. German, in *London Lancet*, Feb. 28, 1885.

all fruitlessly. A fortnight ago I injected into the bladder one-third of a grain of hydrochlorate of cocaine in four or five ounces of tepid water, and retained for ten minutes. Next morning I was pleased to find he had been perfectly free from pain, and the diarrhœa soon ceased. I have since used it four times, the freedom from pain lasting from 26 to 30 hours, but the frequency of micturation and quantity of sediment remained unaltered. The last few days he has complained of similar pain along the urethra, and I intend using the gelatine bougies medicated with cocaine as suggested by Mr. Bellamy.

COCAINE IN CHORDEE.*

I contribute the following as my mite to the therapeutics of cocaine:

I have had two cases recently of chordee, accompanying gonorrhœa which has yielded easily to the soothing influence of an injection of the hydrochlorate of cocaine. The first case I had exhausted almost everything in my efforts to relieve. It was one of those obstinate cases with which we meet sometimes, and which seem to defy all treatment. I gave this man an injection of a four-per-cent. solution mixed with 30 drops of water. After this injection was introduced, I worked it along the urethral canal until the mucous surfaces were bathed in the solution. I then allowed it to remain for several minutes. From this time out I had no further trouble with either the chordee or the patient. The second case yielded a like result.

CIRCUMCISION WITH COCAINE AS THE ANÆSTHETIC.

Prof. Wylie, of New York, reported recently that he had just circumcised a boy while the penis was under the influence of this drug. He used a four-grain solution in which he bathed the prepuce, and he also injected it between the glands and the prepuce. Giving a few minutes to absorb, he then performed the operation. He stated that the boy talked and laughed during the operation.—*Louisville Med. News*, Jan. 31, 1885.

USE OF COCAINE IN LITHOTRITY.

Lithotritry with rapid evacuation of the fragments (Bigelow's operation) was performed recently at St. Peter's Hospital with perfect success. The bladder was injected with a half ounce of a four-per-cent. solution of cocaine, and the operation was begun and completed painlessly in a quarter of an hour.—*Lancet*, Jan. 17, 1885.

* Editorial in New England Medical Monthly, Feb. 15, 1885.

COCAINE IN NASAL AND DENTAL SURGERY.

HYDROCHLORATE OF COCAINE IN THE TREATMENT OF NASAL AFFECTIONS.

While performing some experiments with the hydrochlorate of cocaine to ascertain its value as a local anæsthetic for intra-nasal operations, I noticed that when the mucous membrane covering the turbinated bones was distended—whether as the manifestation of either acute or a chronic inflammatory process—one application of a four-per-cent. solution was sufficient to cause, in three minutes, its absolute collapse.* Not only did it return to its normal thickness, but, when applied to a membrane in which hypertrophic changes had not taken place, the contraction was so great that the conformation of the bone structure beneath could be easily discerned. The state of collapse continued for about half an hour, when the membrane returned to its distended condition.

A glance into the pathological anatomy of the catarrhal affections of the nasal cavities, excepting that characterized by atrophy, will make it evident that we have, in this contracting property of the drug, the very antagonistic power we require in the treatment of those affections. In other words, we have the mechanical constriction inducing absorption which we exert in a much less effective manner with astringents, and pressure by means of bougies, cotton wads, etc.

To illustrate better the force of this assertion, I am obliged to give an outline of the pathological processes of acute, chronic, and hypertrophic catarrh, the three affections in which the drug would seem to be indicated, based upon the observations of Rindfleisch, Cornil, and Ranvier, Heitzmann, Green, Ziemssen, Lewin, Woakes, and others, and my own.

When an acute catarrh, or "cold in the head," is brought on by exposure to cold, the impression made on the peripheral nerves is transmitted through the sympathetic to the vaso-motors of the nasal membrane, and the result is a sudden contraction of its vessels, soon followed by dilatation. The flow of the blood through them is at first hastened, then slackened, and it accumulates more and more as the current becomes slower. After some time the engorgement becomes so great that the serum transudes through the vessel-walls, accompanied by leucocytes, fills the neighboring parts, causing distention, and penetrates through the epithelial layer to the surface of the membrane, dragging along with it some of the leucocytes, or pus corpuscles, and sometimes red corpuscles and epithelium. The distention would be limited, however, were the layer of venous sinuses, or erectile caverns—termed the "turbinate corpora cavernosa," and situated between the membrane proper and

* Dr. F. H. Bosworth, of New York, has reported similar observations, *Medical Record*, November 15, 1884.

the periosteum—not present. These sinuses, most abundant over the turbinated bones, especially at their posterior portion, take an active part in the inflammatory process by becoming filled with the venous blood. As the disease progresses, the secretion, at first thin and watery through the action of the hyperstimulated serous glands, which pour out their normal secretion in excessive quantities, becomes more and more charged with broken-down epithelial cells, lymph corpuscles, pus globules, etc., until it assumes the character of thick, tenacious mucous, or muco-pus, according to the cell elements held in suspension.

Reducing the above to its simplest expression, we have cold as a primary cause, and vaso-motor paresis as a result, followed by the symptoms of secondary dilatation of the bloodvessels: engorgement and transudation through their walls. If we now consider the action of the drug as described, and note, besides, the change of color occurring in the membrane, which sometimes becomes almost white, we can but conclude that it exerts its constringing influence by diminishing the blood-supply, and that in order to do this it must stimulate the vaso-motors. That it does it powerfully cannot be doubted, if we judge by the rapidity of action and the thoroughness with which it is exerted. The membrane proper must not only be influenced, but the venous sinuses must be completely emptied, in order to render possible the absolute contraction induced. To sum up, therapeutically, the powerful stimulation caused by the hydrochlorate of cocaine antagonizes the vaso-motor paresis, thus counteracting the vascular engorgement and the transudation.

It is generally conceded, by the great majority of authors, that an attack of acute coryza cannot be arrested when it has progressed beyond a certain limit, this being due to the fact that the vaso-motors, at first paralyzed by the impression transmitted from the periphery, are kept so by the secondary vascular engorgement until the secretion of the membrane has become great enough to overbalance the vascular exudation, and thus relieve the intramural pressure in the vessels. But if we take into consideration the fact that we can, by powerfully and suddenly stimulating the vaso-motors by means of electricity, extreme cold (ice) or heat (galvano-cautery, or the flame*), cause the distended membrane to collapse, and remain so for a certain length of time, we can easily accept the fact that an agent possessing the same qualities as the above, without presenting the difficulties and giving rise to the secondary pain militating against their use, is a valuable acquisition to our list of remedies for the affection.

As a result of the above conclusions, I determined to try the effects of the drug in a case of coryza as soon as I should be called upon to treat one. But, none being forthcoming, I “took” a cold by exposing my head and neck to a strong draught. I soon began to sneeze violently, my eyes became suffused, and all the symptoms of a mild coryza set in, including “stiffness,” and consequent difficulty of breathing through the nose. Allowing the stage of dryness to proceed, I waited until free secretion had begun, then applied the four-per-cent. solution freely over the two inferior turbinated bones on each side. A sensation of slight heat immediately followed, soon replaced by a feeling of relief and the disappearance of all irritability. At the end of three minutes the “stiffness” had completely disappeared, and did not reappear until about three-quarters of an hour later. A renewal of the application was followed by the same results, while, after a third, the distention and consequent stenosis did not recur.

Although the attack was not severe enough to present much resistance to the action of the drug, it was sufficiently so to indicate a positive power to overcome the paralyzing action of the peripheral irritation. I have not the least doubt, however, that in a severe case local applications of a four-per-cent. solution of hydrochlorate of cocaine to the membrane, and quinine internally to antagonize the systemic disturbance, would afford a more rapid and effective result than any treatment now at our disposal.

* Vide *La flamme à petites dimensions*, par Louis François Gondret, Paris, 1847.

In simple chronic catarrh, the momentary state of the vascular supply during an acute attack has become reduced to permanency, the repeated distentions to which the vessels have been subjected have finally caused these to remain distended in irregular fusiform dilatations, and their walls have become softened and more permeable. The layer of venous sinuses or "turbinate corpora cavernosa," although but slightly influenced organically, are more susceptible to irritation, and the least exposure causes their excretion. As a result, the already decreased lumen of the cavity becomes more limited, until, in some cases, absolute stenosis exists at each exacerbation.

It is in this class of cases that the constricting action of the drug principally shows itself. In seven cases in which I have used it, its power was as manifest as in acute coryza. Notwithstanding the paretic state of the vaso-motors, made evident by the marked vascularity in the non-irritated state, its action, although not quite as rapid, was as marked. So empty had the parts become of all fluids that the density of the membrane was such that firm pressure with a probe did not produce the least depression. In order to bring about this result, the venous sinuses had to be emptied of their venous blood, the vessels of their contents, while what infiltration was present had to be suddenly absorbed. The state of the membrane after the application indicating that these conditions had been fulfilled, we cannot but conclude that each abnormal condition forming the pathological state had been antagonized, and that the drug presents the necessary qualities for curative treatment, *i. e.*, stimulation of vaso-motors, relief of vascular distention, absorption of infiltration and of the new connective-tissue elements, which frequently transform the simple chronic state into that accompanied by hypertrophy.

In order to test practically the truth of this hypothesis more time is naturally required than a period of three weeks, since which the experiments were begun. I can only as yet report less tendency to frequent exacerbation and great satisfaction on the part of the patients to be able at any time to arrest the partial or complete stenosis, which most frequently affects them during the night and interferes with sleep.

In the hypertrophic variety we have to contend with firmly organized adventitious connective tissue, besides the conditions existing in the simple chronic state. New vessels have been formed, the epithelial layer has become thickened; in short, we have a condition which surgical interference or mechanical action only can modify. A number of authors advise pressure by means of hard rubber or metallic bougies for the reduction of the redundant membrane by absorption, and report excellent results. Although I do not make use of this method, considering it too painful and as a slow and tedious way of obtaining results which we can reach by much simpler and more rapid means, I avail myself of the fact it seems to prove, *i. e.*, that this firmly organized adventitious connective tissue *can* be absorbed along with the other adventitious elements. Accepting this fact, and turning our attention to the contracting power of the hydrochlorate of cocaine, it seems but rational that that contracting power is the very *desideratum* in the treatment of this hypertrophic variety by induced absorption, its value being much enhanced by the painlessness of its application. Here, again, time is necessary to turn a pure hypothesis into a certainty, but the prize is sufficiently valuable to merit serious trial.

In hay fever, I doubt whether it will have any value other than a momentary abatement of the hyperæsthetic condition of the nasal membrane, and to diminish the intensity of the nasal symptoms. As a preventive, it could only be effective by applying the solution every half hour during the usual six or eight weeks of exposure, a rather unpleasant task, and one calculated to become as tedious to the patient as the disease itself.

As an anæsthetic for nasal operations, my experiments so far have not realized my anticipations. Of the fourteen cases in which they were performed, two only showed marked effect. I first tried the two-per-cent. solution, then the four-per-cent., and at last the ten-per-cent., and, to my surprise, noticed no difference in the actions of the two latter. The

three solutions had been obtained at a most reliable drug store, that of Mr. Llewellyn; they were tried and found "excellent" by my colleague of the eye clinic at the Jefferson College Hospital, and were used by me carefully and repeatedly at intervals of five minutes, after drying the membrane with absorbent cotton. In applications of glacial acetic acid, the short but burning sensation was slightly modified, while in galvano-cauterizations the slight pain accompanying flat applications was somewhat diminished and shortened. In all of these cases the contact of the probe was not felt immediately before the applications and the pain when the galvano-cautery was used only became evident when the instrument had penetrated the superficial layer.—Chas. E. Sajous, M. D., in *Medical News*, Dec. 20, 1884.

COCAINE IN INTRA-NASAL SURGERY.*

On the receipt of the intelligence of Koller's experiments† with cocaine, through Dr. Noyes' communication to the *Medical Record*, the first thought was naturally one suggestive of startling possibilities corresponding in direction with the reader's line of inquiry. In response to this impulse I have conducted a series of experiments with the new anæsthetic in operations upon the nares, and in view of the remarkable and positive character of the results obtained, feel encouraged to relate my experience, with certain additional corroborative testimony.

My first experiments, conducted several weeks since with a two-per-cent. solution of the salt, were not extended on account of the unfavorable impression received. Though sceptical regarding the action of this solution for my purposes, I was, nevertheless, inclined to expect better results from a stronger preparation. A four-per-cent. solution of the crystalline hydrochlorate of cocaine was afterward obtained from a different source. My method of applying the salt consisted in placing pledgets of absorbent cotton in contact with the structures requiring removal, and projecting upon them, by means of a glass tube, from five to ten drops of the cocaine fluid. The cotton once moistened can be used several times at a single sitting; indeed, cotton saturated with the fluid and afterward dried will remain cocaineized for many hours. I employ an exceeding fine home-made spray to produce more extensive effects.

The cases reported have been selected on account of the exaggerated sensibility of the structures involved, and as such offer excellent evidence of the powerful analgesic action of cocaine.

Mr. M——, banker, consulted me on account of an annoying nasal catarrh. Examination revealed, among other things, a deviated septum pressing against a congestive hypertrophy of the left antero-inferior turbinated tissues. The deviated cartilage extended as a narrow horizontal ledge to the osseous edge of the septum, and obstructed nasal respiration through the left nostril. When employing a probe to point out the site of the affection, it happened to lightly touch the septum. The patient started as if severely injured, and invariably exhibited signs of intense discomfort. When the manipulation was repeated, intense sensitiveness was exhibited, and my prospects of assistance from the patient in a deliberate operation could hardly have been less favorable. A pledget of absorbent cotton was inserted in the nostril, against the abnormal structures, and a few drops of the cocaine fluid placed upon it by means of a camel's-hair brush. At the expiration of twenty minutes the cotton was removed. The first effect observed was the retreat of the lower turbinated tissue from contact with the septum, thus affording more room for the operative manipulation. This peculiar action of the cocaine has already been described by Dr. Bosworth. I tentatively nipped off a piece of the septum with my fenestrated cartil-

*By William Chapman Jarvis, M.D., Lecturer on Laryngology in the New York University Medical College.—*N. Y. Med. Record*, Dec. 13, 1884.

†*Wiener Medizinische Wochenschrift*, No. 44, 1884.

age forceps; the procedure, according to the patient's statement, was perfectly painless. Emboldened by this I commenced work in earnest, the slight amount of bleeding enabling me to continue operating uninterruptedly for five minutes. During this interval the patient declared there was an entire absence of sensation. The parts were then cleansed of tissue débris. In five minutes sensation had returned. I reapplied the cocaineized cotton, and after leaving it in five minutes, proceeded with the operation. In this interval I removed the whole length of the remaining deviated cartilage. The patient could with difficulty find words to express his profound sense of satisfaction.

Amanda D—, aged sixteen, referred to me by Dr. S. Hemingway. Congenital occlusion of the nares from malformation of nasal and turbinated bones. Bridge of the nose almost entirely wanting. Interocular space very broad, falling of the lower jaw, with associated signs of habitual mouth-breathing. Both nostrils impacted with flesh-like masses, having almost the firmness and elasticity of rubber. The structures were jammed so tightly against the wall of the septum as to give at first sight the impression of its fusion with the cartilage. The turbinated tissues present none of the usual signs of hypertrophied membrane, having the appearance of slightly congested turbinated tissues, and having only a trifling tendency to retract when touched with cocaine. The tissues still possessed a sensibility evidently equalling that of the normal erectile structures. The posterior nares were obstructed. A case of congenital stenosis successfully treated by me several years since presented many features in common with this one.*

I had operated on Amanda D— on a previous occasion, employing my transfixion needle and éraseur. The child did not possess a particle of fortitude, causing a great deal of trouble by her persistent crying, and in spite of every precaution for her comfort she proved herself to be one of the most intractable patients I ever had to contend with. This state of hyperæsthesia was probably due to the prolonged contact of these delicate tissues with the septum narium. The case was an excellent one for the employment of cocaine. I therefore placed a pledget of absorbent cotton in the left nares, and moistened it with a few drops of the solution, carried into the nostril by a camel's-hair brush. After the expiration of fifteen minutes I removed the cotton, and deliberately transfixed the pale tissues, the passage of the needle, as stated by the patient, causing absolutely no pain. The loop was likewise painlessly introduced, and the operation satisfactorily completed.

After an interval of five days I continued operating, replenishing my cocaine bottle from a neighboring druggist. The solution, though applied as in the first instance, did not have the desired effect. I then procured a fresh solution from still another druggist. This fluid likewise failed. Later in the day I procured some of the original preparation, and found it as effective as in the first instance. Small portions of the turbinated bodies were successfully removed by means of the fenestrated cartilage forceps, an expeditious but more painful and bloody method than excision with the wire, and therefore never employed by me for this purpose. The controlling influence of the cocaine over the blood supply removed this objectionable feature, and furnished a clear field for operation. As the incisions gradually included the deeper-lying tissues they became sensitive, requiring fresh applications of the cocaineized cotton.

Mr. P—, merchant, thirty-two years of age, was seen by me in consultation with Dr. Bellows, of Brooklyn. The patient had been unable to breathe through the nose for fourteen months. The nostrils closed gradually, the right being the first to become involved.

Dr. Bellows informed me that he had already been in the hands of a physician, who employed the galvano-cautery for several weeks. A surgical procedure of a

*Archives of Laryngology, vol. iii. 188.

more formidable character was next employed, the patient emerging from etherization only to be confined to the house for three weeks on account of the severity of the operation, and an otitis media acuta set up by the traumatism. After recovering from these unfortunate sequelæ his condition was worse than before the operation. An examination showed the right nostril to be entirely occluded by a combined deviation of the septum and turbinated hypertrophy. A very narrow chink in the left nostril permitted the occasional entrance of a feeble current of air, enabling the patient to partially remove the pent-up nasal secretions. It possessed, however, very little respiratory value.

I have been gradually clearing the nostrils for several weeks, removing small portions of the tissues in such a way as not to interfere with the patient's business. Although the careful excision of small portions of bone and cartilage greatly diminished his suffering, there were, nevertheless, moments when he complained severely of the pain inflicted by the *ronguer* and cutting forceps. I employed cocaine by placing small bits of absorbent cotton in contact with the already wounded and tender surfaces, and dropping the solution upon it by means of a pipette. In thirty minutes the pledgets were removed and a tentative test made. Although the forceps inflicted pain, superficial sensation was reduced to a degree permitting the stripping off of membranes partly divided in a previous operation. Another application of cocaine was made, the cotton being again removed after an interval of fifteen minutes. I then commenced to divide the tissues, and was told to continue the operation, as no pain was inflicted. I continued operating for three minutes, when the patient interrupted me while cutting away the deeper structures over the vomer. In this interval bone and cartilage were alike divided without causing the slightest pain. This method of alternately benumbing and cutting was continued for more than two hours and a half, the patient being in the best of spirits during the entire interval. He left the office breathing through a free opening into the posterior nares, and thoroughly convinced of the pain relieving properties of cocaine.

The following history, reported through the courtesy of Dr. William Vanderpoel, offers additional evidence in a case in which my *écraseur* was recommended: Mrs. Annie M——, aged twenty-nine years and six months, pregnant, presented herself at my office, November 3d, suffering from a growth in the left nostril which protruded three-fourths of an inch, was about three-fourths of an inch in diameter, of dark red color, firm upon pressure, and insensible to ordinary manipulation. Two months previous she had come to me, presenting a small growth in the left nostril, which had all the characteristics of an ordinary gelatinous polypus. Under ordinary circumstances I should have removed it at once; but considering the fact that she was then four months pregnant, and had previously miscarried three times, in each instance with profuse flooding, I feared the shock of an operation and ordered a spray of carbolic solution ($\frac{1}{100}$), under which treatment the growth seemed to disappear, but a month later returned.

Still fearing an operation, on November 9th I injected the tumor with a few drops of glacial acetic acid, and also gave the patient a powder, composed of tannin, to be snuffed up the nostril as best she could. On November 15th, there was little improvement, so I decided upon an operation. To lessen the pain and shock of the operation, I employed the muriate of cocaine. two-per-cent. solution, applied with a camel's-hair brush, to inside of the nostril, as well as the tumor would permit the insertion of the brush.

I made three applications at intervals of ten minutes, using in all 3 ss. of the solution, or about one grain of cocaine muriate. The first application was rather painful from the application of the brush, but the subsequent ones caused no uneasiness. The Jarvis' snare was then applied without discomfort, and passed well up to the root of the tumor, which seemed to have origin from the middle turbinated bone. No pain was experienced during the operation, and after an hour and a half the tumor came away, the patient

not losing more than a few drops of blood during the entire operation, and no hemorrhage followed it.

In addition to the foregoing cases I have employed cocaine to remove polypi and hypertrophied turbinated tissues, and have found it useful to facilitate the practice of posterior rhinoscopy and to alleviate pain in the larynx and pharynx. I do not consider its employment urgent in the removal of polypi and turbinated hypertrophies, since these growths, especially the former, can be in most instances removed with little or no pain by means of my nasal écraseur. The time required to make the operation painless with the snare is necessary also to prevent the occurrence of annoying hemorrhage. Although cocaine at times restrains bleeding, its action in this respect is not necessarily permanent. I have observed tissues pale and bloodless when divided under the influence of cocaine. bleed profusely as soon as the effect wore off. The employment of cocaine in the nostril has been referred to in this country by Bosworth, Bettman, Ingals, Knapp, Gruening, and Claiborne.

Conclusions.—Cocaine is useful in intra nasal surgery, as a local anæsthetic, for the removal of deep as well as superficial tissue abnormalities.

2. Repeated applications are required for the removal of the deeper structures, the time requisite for anæsthesia always being shorter after the first effect has been obtained.

3. By promoting quiet and preventing secretion, hemorrhage, and sneezing, it facilitates the employment of cutting instruments within the nasal cavity.

4. The action of cocaine for profound anæsthesia depends upon the quality and quantity of the salt.

NOTE ON THE USE OF COCAINE IN HAY FEVER.*

The remarkable success which has attended the use of cocaine in cases of hay fever, is one of the most interesting developments in the therapeutical history of this surprising remedy. The curative power thus exhibited, throws a clear light on the pathology of this singular malady. The various theories of the pathogeny of hay fever may be resolved into two: one, that its manifestations are local, and due to the deposit of some irritating material; the other, that its real origin is systemic, a peculiar state of the nervous system being necessary to its production, and secondary to this, a disturbance in the peripheral expansion of the nerves distributed to the broncho-pulmonary mucous membrane. There can be little doubt that both theories contain a truth, but they do not have the essential requisites of a satisfying theory, in that neither one reconciles all the facts.

Until Blackley came forward with his experimental investigations, the theory of a local cause had no other support than vague surmises. When he demonstrated that the pollen of certain plants possessed the precise irritating qualities to excite the peculiar local disturbances, the case seemed to be closed in favor of the local-action theory; but it was soon seen that there are other necessary elements in the morbid complexus. We owe, more especially, to the late Dr. George M. Beard, the demonstration of these elements and the correlation of the phenomena of nervous origin.

As all persons in any given community are alike reached by foreign bodies in the air, it is obvious that those stricken with hay fever must possess a special susceptibility to the irritating cause.

To produce 'hay fever' a peculiar type of nervous system is necessary. In such subjects, the contact of the pollen of certain grasses, or of certain other irritating matters, as for example, powdered ipecacuanha, is necessary. These conditions being present, the mechanism of the disease is as follows: a greater or less congestion of the nasal mucous

* By Roberts Bartholow, M. D., LL. D., Prof. of Materia Medica, General Therapeutics and Hygien in the Jefferson Medical College of Philadelphia.

membrane, and implication of the terminal filaments—end organs—of the fifth nerve of the sympathetic, ensue; hence, the swollen state of the membrane, the acrid and abundant secretion (catarrh), the subjective distress and the formation of "sensitive areas." The sneezing, the asthmatic symptoms, and other nervous phenomena are purely reflex effects, readily explained by the anatomical relations of the affected nerves. Vulpian had, long ago, shown that ablation of the sphenopalatine ganglion—a centre of the sympathetic nervous system—was speedily followed by a profuse catarrh of the nasal mucous membrane. The nucleus of the fifth nerve has closed physiological relations, if not actual commissural connections, with the nucleus of the pneumogastric nerve. Hence, a reflex disturbance originating in the terminals of the fifth, may thus involve the terminals of the pneumogastric and its associated nervous connections, causing amongst other nervous disturbances, asthmatic symptoms.

A remedy for hay fever to be curative or powerfully palliative, must accomplish one or both of two objects: it must arrest the local irritation; it must prevent the reflex disturbance. It must so affect the nasal and faucial mucous membrane as to remove any special susceptibility that exists, and put the individual so affected in the state of the majority of the population who breathe with impunity air charged with irritating materials. Have we such a remedy? We can conceive of a germicide, or antiseptic, sufficiently powerful that if efficiently applied in time, the initial disturbance may be prevented or arrested. Helmboltz, and a few imitators, have succeeded by a happy application to the nares, of a solution of quinine. Unfortunately, the numerous agents, so perseveringly employed in this way, have in almost all instances failed in any permanent effect. It remains to be seen how far cauterization of the sensitive areas, so admirably advocated by Dr. Sajous, will prove curative. This method is widely intended to arrest the transmission of irritating impulses originating in the nasal mucous membrane.

Since preventative measures and the arrest of the initial disturbances have hitherto proved migatory, the attention of sufferers has been directed to means of relief for the more distressing symptoms. Until the powers of cocaine had been made known, not much of a satisfactory character had been achieved, and the one remedy for the great army of sufferers, consisted in a complete change in the climatic conditions. At last, a peculiar mode of applying cocaine, seemed to have solved the problem.

Before Dr. Köller, of Vienna, had demonstrated the anæsthetic effect of cocaine, laryngologists had used it to some extent to lessen the sensitiveness of the faucial mucous membrane. Nothing in therapeutics is more wonderful than the power of this agent to allay the sensibility of the nerves of the mucous membranes generally, and it is this, which Dr. Köller, especially showed. It naturally followed on this demonstration, that the agent would prove useful in all irritable states of the mucous membranes, and hence, when the annual sufferings from hay fever began, the victims, especially when physicians, looked to cocaine for relief. Unfortunately, the usual solution, when applied, was useful chiefly in the milder cases, for the profuse discharge in the severer cases, either diluted the agent so far as to make it inactive, or washed it away before it could act on the part. This agent complies with singular completeness to all the conditions of the therapeutical problem, set forth above. It relieves that hyper-sensitiveness of the mucous membrane, which separates the hay fever victim from all other normal subjects. It allays the irritability of the end organs of the nerves, of animal and organic life, and thus, whilst it relieves the local distress, removes the congestion, and checks the secretion. It acts also, on the next link in the chain of morbid impressions, and arrests the wide-spread, reflex disturbances having their common point of transmission in the nuclei of the fifth, and pneumogastric nerves.

COCAINE IN DENTAL SURGERY.*

The hydrochlorate of cocaine, like all new remedies which have promised to mitigate the sufferings of mankind, was hailed with enthusiasm; and in certain lines of practice it is already gaining a firm foothold as a local anæsthetic, principally in ophthalmology and in many operations upon mucous and serous tissues. On the other hand, the subject has lost much of its interest to dental surgeons from the fact that it has proved a disappointment where it was hoped that it would be of the greatest benefit, viz.: as an anæsthetic or obtunder of sensitive dentine. And now that the enthusiasm over the drug has waned, and we begin to investigate its claims with cooler heads and less biased judgment, many of the published accounts of its wonderful effects upon the sensitive dentine and the other tissues of the teeth it would seem must have originated very largely in the imagination of the writers rather than that they were clinical facts.

New forms of the drug have, however, been more recently introduced which promise better results; and my excuse in presenting this paper is to call your attention to the citrate of cocaine by presenting the results of a series of experiments made with the hydrochlorate, the oleate, and the citrate; leaving you to judge which promises to be of the greatest benefit as a local anæsthetic or obtunder of sensitive dentine. For operations upon mucous tissues there seems to be but little difference between any of these forms, but upon sensitive dentine and pulp tissues it will be seen that the citrate in my hands proved much more satisfactory than either of the others.

To illustrate the effects of these three forms I have chosen from my records the first ten cases upon which each of these remedies was tried:

The Hydrochlorate, or Muriate of Cocaine.— $C_{17}H_{21}NO_4 \cdot HCl$ contains about 88 per cent. alkaloid cocaine, and is made by neutralizing the alkaloid with HCl , using as little water as possible and evaporating until crystallization takes place. When this remedy was first introduced as a local anæsthetic we had great hopes of it as an obtunder of sensitive dentine, but after repeated trials with a two-per-cent. solution, my enthusiasm cooled, for in nearly every case it was more or less a failure. This I attributed to the fact that a dense tissue, like dentine, absorbs so slowly that a sufficient quantity of a two-per-cent. solution could not be taken up to produce anæsthesia, and therefore concluded that the solutions needed to be stronger. To test this I procured ten-per-cent. and twenty-per-cent. solutions, but was unable to get any better results with the twenty-per-cent. than with the two-per-cent. solution. A forty-per-cent. solution has also been recommended. This I have not tried, but from the experience of others who have experimented with it, it seems to have no advantage over a four-per-cent. or ten-per-cent. solution.

CASE 1.—Mrs. Dr. D., aged 30, just recovered from her third confinement. Several large cavities to fill. Teeth soft and very sensitive. Applied a two-per-cent. solution of hydrochlorate of cocaine (Foucar's) to two buccal cavities extending under the gum, the inferior left first and second molars. The cavities were first dried and then painted with the solution. In five minutes this was repeated, and at the end of ten minutes the rubber dam was applied without pain, and the cavities excavated with so little discomfort as to call forth expressions of delight from the patient.

CASE 2.—Willie S., a frail boy aged 15 years, a frequent sufferer from nervous sick-headache, and obliged to give up study on this account. Teeth soft and exquisitely sensitive, and from his nervous condition the operation nearly unbearable. Applied the two-per-cent. solution to a large crown cavity in the inferior right second molar; after four applications at five minute intervals could obtain no appreciable effect.

CASE 3.—Mrs A. J. L., age 24 years, in good health and nursing her first child, aged

* Read in the Section of Dental and Oral Surgery, at the Thirty-Sixth Annual Meeting of the American Medical Association.

9 months. Teeth of medium structure and only normally sensitive. Adjusted the rubber dam to the superior left second molar and applied the two-per-cent. solution to a distal cavity three times at five minute intervals, but at the end of 20 minutes there was no diminution of sensation.

CASE 4.—Mrs. L., aged 24 years. Applied the two-per-cent. solution to the necks of the inferior anterior teeth and gums, these teeth being affected with pyorrhea alveolaris. After two applications at five minute intervals, the gums were completely anæsthetized, and I was able to operate with very little pain. At a previous sitting, without the aid of cocaine, the operation was exceedingly painful.

CASE 5.—Mr. L. E., aged 50 years. Health fair. Applied a ten-per-cent. solution for the extirpation of a living pulp, the rubber dam being previously adjusted and the pulp fully exposed, but after four applications at five minute intervals there was no abatement of sensation.

CASE 6.—Miss Celia D., domestic, aged 26 years. Health good and teeth of fair structure. Applied a ten-per-cent. solution three times at five minute intervals to four cavities in the inferior left bicuspid, with very slight diminution of sensitiveness.

CASE 7.—Dr. McG., a professional friend, aged 26 years. Teeth strong and dense. Made three applications of a ten per-cent. solution at five minute intervals, to two large and sensitive cavities in the superior left first molar, but could get no favorable results; on drying the cavities with the hot air blast was able to excavate with considerable mitigation of the pain.

CASE 8.—Master George L., aged 14 years. Health not very good; suffers from headache on the least nervous excitement. Teeth very soft. The application of Merck's twenty-per-cent. solution in the same manner and at the same intervals to several sensitive cavities seemed to afford a little relief. The hot-air blast was also used and seemed to afford still greater relief.

CASE 9.—Master Charles H., age 16 years, and in fine health. Teeth medium in structure. A twenty-per-cent. solution was applied, as above, to several teeth at different sittings with only a very slight abatement of the sensitiveness. The hot-air blast was also used in this case upon teeth which had been treated with the twenty-per-cent. solution, and upon teeth which had not; and the sensitiveness was lessened just as much in those teeth where the hot-air blast was used alone, as where it was used in connection with the cocaine.

CASE 10.—Mrs. L. B. M., aged 24 years. Health good; teeth medium in structure. Applied a twenty-per-cent. solution to two very sensitive cavities four times at five minute intervals, but with no perceptible benefit

Oleate of Cocaine.— $C_{17}H_{21}NO_4$, $C_{18}H_{33}O_2$. Normal oleate of cocaine contains from 43 to 52 per cent. alkaloid cocaine, and is prepared similarly to the hydrochlorate, using oleic instead of hydrochloric acid.

CASE 1.—Annie O. B., dispensary patient, aged 12 years. Applied five per cent. oleate to the gums for the extraction of an abscessed inferior right molar. Made three applications at three minute intervals. Gum lost sensation in eight minutes, and the tooth was extracted at the expiration of 12 minutes. Patient said: "It hurt very badly."

CASE 2.—Mr. K., dispensary patient, aged 40 years. Applied five per cent. oleate to the gums for the extraction of the root of the superior right first bicuspid, which was the seat of an abscess, and very sore to the touch. Made two applications at three minute intervals. At the end of seven minutes the gums had lost sensation, and in ten minutes from the first application the tooth was extracted. The patient declared the pain was considerable, but not so bad as he expected.

CASE 3.—Mr. E. F., Sr., aged 60. Teeth dense. Attempted to extirpate a living pulp for this gentleman from the inferior left second bicuspid. Applied the five per cent. oleate twice at three minute intervals; at the expiration of ten minutes there was no anæ-

thetic effect. Made a third application, and at 30 minutes—the pulp being bathed in the oleate all this time and moisture excluded by the rubber dam—there was no appreciable anæsthetic effect. Then applied the normal oleate for 15 minutes with no better success.

CASE 4.—Mrs. T. H. B., aged 30 years, and in the most perfect health. Teeth medium. Applied five per cent. oleate to a crown cavity in the inferior right wisdom tooth. Made three applications at five minute intervals; slight pain on making the first application. At the expiration of 25 minutes there was no effect.

CASE 5.—Mrs. George A., Jr., aged 28. Health not very good. Teeth soft. Is a frequent sufferer from nervous headache, and exceedingly nervous about dental operations. Applied five per cent. oleate to a very sensitive crown cavity inferior left second molar. The dam was adjusted and the cavity bathed with the remedy; at the end of ten minutes no effect; at 20 minutes the same; at 30 minutes still no abatement of sensitiveness. The normal oleate was then applied for ten minutes with no better result. (Since recording the above I have tried the citrate upon another tooth for this patient, equally as sensitive as the one just mentioned, with entire success.)

CASE 6.—Master Joe. R., aged 11 years. Teeth soft and very sensitive. Applied five per cent. oleate in the usual way to several cavities, and followed it with a hot-air blast, but was unable to completely obtund the sensitiveness. (At still other sittings of a later date have used the citrate with entire success.)

CASE 7.—Miss Margaret M., aged 14 years. Highly nervous organization. Teeth of fair structure, but exceedingly sensitive. Applied five per cent. oleate to two cavities four times at three minute intervals, but with very slight obtunding effect.

CASE 8.—Mrs. Anna B., aged 40 years. Health good. Applied the five per cent. oleate to the gums preparatory to fitting the band for an artificial crown, upon the root of the superior left central incisor. In 15 minutes anæsthesia of the gum was perfect, but at the border of the alveolus, sensation was still acute; this I was unable to overcome after an hour's trial.

CASE 9.—Miss J. P., aged 35 years. Health much impaired from long-standing uterine trouble. All the teeth troubled with pyorrhea alveolaris. Applied five per cent. oleate twice at five minute intervals, and in 15 minutes was able to scrape the roots of the teeth and slit open the pockets with very little pain.

CASE 10.—Mrs. E. B., aged 42 years. Health good, teeth dense and only normally sensitive. Two applications of the five per cent. oleate at ten minute intervals diminished the sensitiveness, but it was not entirely overcome.

Citrate of Cocaine.— $(C_{17}H_{21}NO_4)_2 H_8C_6H_5O_7$. Contains about 80 per cent. of alkaloid cocaine, and is made after the same process as the other forms, except that citric acid is used. My attention was first called to it by a letter to the *Journal of the American Medical Association*, written from Wiesbaden, Dec. 4, 1884, by Dr. Sarah Hackett Stevenson. I at once took steps to secure a sample for experimentation. A sample was prepared for me, and made into pills, each containing one-fourth grain; the excipient used being gum tragacanth dissolved in glycerine. This readily dissolves on being moistened with water, and therefore makes a very convenient vehicle for its introduction into the cavity. The citrate does not keep well in solution as it decomposes in three or four days. My method of using it is as follows: Remove all loose *debris* from the cavity, wash out with tepid water and apply the rubber dam. Place in the cavity one-sixteenth or one-eighth grain of the citrate (divide the pill into two or four equal parts), according to the size of the cavity, and place over it a pledget of cotton, moistened with tepid water; the excipient soon dissolves and flows over the surface of the cavity. In five minutes I test the dentine, and if still sensitive make a second or third application.

CASE 11.—Miss Eva J. B., aged 26 years. Health good. Teeth soft and very sensitive. Applied one-sixteenth grain of the citrate to a distal cavity in the superior right

lateral incisor. Slight stinging pain on application; this subsided in about three minutes; in five minutes the tooth felt benumbed (as described by the patient); in ten minutes the cavity was excavated without the least pain. The anæsthetic effect lasted for about one hour.

CASE 2.—Miss N. E. C., aged 19 years. Health fine. Teeth of good structure but quite sensitive. Patient has a great dread of dental operations. Applied one-sixteenth grain of the citrate. Slight pain on coming in contact with the dentine; this soon subsided, and in five minutes the sensitiveness was considerably lessened. Made a second application of one-eighth grain, which was allowed to remain five minutes, when sensitiveness had entirely disappeared, and the operation was completed without the slightest pain.

CASE 3.—Mrs. John J. Jr., aged 35 years. An exceedingly nervous patient, and more or less an invalid for the last ten years. Teeth soft. Applied one-eighth grain of the citrate to a superficial cavity on the mesial surface of the superior right first bicuspid. Dentine exquisitely sensitive to heat, cold, acids, sugar, etc., and the least touch of the excavator caused intense pain, and throws the patient into a nervous tremor. Severe pain followed the application of the citrate, which did not subside until 20 minutes afterwards. Made a second application of one-eighth grain ten minutes after the first. In 20 minutes from the first application was able to partially excavate the cavity; a third application of one-sixteenth grain was then made, and in 30 minutes from the first was able to finish the operation. The patient said the tooth was still sensitive but endurable. I had tried some weeks previously to excavate the cavity, under the effect of a Merck's twenty-per-cent. solution, but failed to obtain any favorable results with it.

CASE 4.—Miss C. E. N., aged 20 years. Health good. Teeth of fair structure. Applied one-sixteenth grain of citrate to two sensitive proximal cavities in the superior left first and second bicuspid. Slight pain on application; at the end of five minutes sensitiveness was entirely overcome in both, and the operation was completed without pain.

CASE 5.—Mrs. John B., aged 30 years. In fair health. Removed the remnants of the pulp in the superior right first molar, which had resisted devitalization after three applications of arsenious acid. The pulp was hypersensitive in all three roots. In 15 minutes after the application of one-eighth grain of citrate, was able to remove the pulp without the least pain.

CASE 6.—Miss Alice C., aged 16 years. Health Good. Teeth soft. Suffering severe odontalgia from exposed pulp in the inferior right first molar. Applied one-sixteenth grain citrate for the relief of the odontalgia; in five minutes I made a second application, and in ten minutes a third, each time doubling the dose, but after a full half hour there was no mitigation of the pain. Dressed with oil of cloves and one-eighth grain morphia sulph., with the effect of controlling the pain in about five minutes.

CASE 7.—Mr. Henry C., aged 18 years, in poor health. Teeth soft and very sensitive. Applied one-sixteenth grain to a buccal cavity in the inferior left second molar. Severe pain followed the application, which lasted about five minutes. Made a second application of one-sixteenth grain, and in 15 minutes excavated the cavity without pain.

CASE 8.—Miss Anna P., aged 24 years. Health good. Teeth of dense structure. Applied one-sixteenth grain each to two buccal cavities in the superior right and left second molars. Slight pain on application, which lasted about three minutes. In ten minutes was able to operate without pain.

CASE 9.—Miss Sophia N., aged 23 years. Health good. Teeth soft. Applied one-sixteenth grain each to two mesial cavities in the superior right and left central incisors. Very slight stinging pain on application. At the expiration of 15 minutes dentine still sensitive; made a second application of one-sixteenth grain, and in 30 minutes the den-

tine was slightly sensitive at the bottom of the cavities. Operated with but little pain.

CASE 10.—Mr. J. C. S., aged 20 years. Health good. Teeth dense, and only normally sensitive. Applied one-sixteenth grain each to several cavities, and in each of them one application was sufficient to completely obtund the dentine in from eight to ten minutes.

Since recording the above cases I have had opportunity to more thoroughly test the merits of the citrate, and as an obtunder of sensitive dentine it has in my hands fulfilled in nearly every instance all that it gave promise of doing. From the cases recorded you will notice: 1. That it is much more reliable when applied to sensitive dentine than either hydrochlorate or oleate. Whether this is due to the special form of the drug or to its greater concentration as applied to the dentine, I am unable to say. 2. That it also seems to act more promptly, whether applied to sensitive dentine, pulp tissue, or mucous membrane, than either of the other forms. 3. In every case, so far, in which I have used it for obtunding sensitive dentine, the citrate causes a more or less sharp, stinging sensation, being similar to that produced by the application of spunk or bibulous paper in drying the cavity, or of mild solutions of chloride of zinc; but this passes away in from two to five minutes. Why the application of the citrate should produce pain I am unable to say, unless it is caused by the rapid absorption of the fluids contained in the dentinal tubuli; as the citrate and the glycerine excipient have strong affinities for water, or possibly the citric acid is not completely neutralized. Why case 5, in which the citrate was applied for the removal of a pulp, should be so successful, and the next case, in which it was used for the relief of odontalgia, should prove such an utter failure, is to me also equally unaccountable.

The record of such a small number of cases, apparently successful, does not of course prove the citrate to be a perfect local anæsthetic for operations upon the teeth, but I trust they will be useful in calling attention to this form of the drug, and stimulate others to further test its merits.

COCAINE IN DENTAL SURGERY.*

Having read with interest the reports which have appeared week after week of the various uses to which cocaine has been put, I thought a few particulars of my experiments with it in dental surgery might be interesting.

For extraction, I have tried both the solution and the hydrochlorate of cocaine itself, and, with the latter, have obtained very satisfactory results. It seems to answer best for front teeth and bicuspid, also for stumps when separate. The following case will show the method adopted, etc.

R. W., a porter, aged 20, came to the Dental Hospital to be relieved of a lower right second bicuspid, which was above the average size and quite firm. I first surrounded the tooth, and about half an inch of the gum around it with the corner or a napkin, to keep the parts dry, and prevent the cocaine from being carried off in the saliva. I then freely applied the crystals to the gum close around the tooth three times, at intervals of two minutes each. After the second application, the gum was entirely anæsthetised, the patient not feeling the pricks of a sharp probe. A few seconds after the third application, with a pair of warm forceps, which I carefully hid from view, I extracted the tooth, and said nothing for some time. At last I desired the patient to wash out his mouth, but he began to smile, saying the tooth was not out; nor would he believe that it was until he had felt the empty socket with his finger.

With large teeth I have found it a good plan to treat as above, and then, just before

*Cases under the care of J. McKno Ackland, M.R.C.S., L.D.S. Eng., Exeter.

extracting, to introduce the nozzle of a fine hypodermic syringe between the gum and neck of the tooth, and inject three or four minims of the 4-per-cent. solution. This may not, however, be possible in all cases.

With molar teeth, more especially upper, although the pain is greatly diminished, there is always the twinge of the actual separation of the tooth from its socket, and the rupture of the nerves, etc., at the apices of its roots.

In all the cases I have seen, the gum has returned to its normal estate in a short time, and there has been no unfavorable symptom of any kind, although I have carefully watched for them both locally and otherwise. As an obtundent for sensitive dentine, the 20-per-cent. solution has proved, so far, very effectual. By applying it on a pellet of cotton wool for a short time, I have been enabled to proceed with the preparation of a cavity for filling, which before has caused the patient the most acute pain; and a solution of this strength will, I think, be found of great advantage in cavities in close proximity to the nerve or even in operations on the nerve itself.

COCAINE IN DENTAL SURGERY.

When cocaine was first introduced, both dental surgeons and their patients were very sanguine as to its value in reducing the excessive painfulness of operations in dentistry, and they hoped it could be used for allaying the sensitiveness of dentine when the caries was being excavated previous to "filling" the cavity. They also hoped it might be found useful to relieve the pain attending extraction of teeth and roots. The subject was introduced at the December meeting of the Odontological Society by Mr. Oakley Coles and Mr. S. J. Hutchinson; but their experience and that of the members present who joined in the discussion did not seem to point to any tangible results as to the effects of this drug. Most of those present agreed that in the 4-per-cent. solution the action was almost inert on dentine, though it would relieve the sensitiveness of an exposed "pulp." Since then various experiments have been made with a twenty-per-cent. solution and with the hydrochlorate of cocaine in its crystalline form. The latter seems in a certain number of cases to produce a distinct abatement of *pain*, although *sensation* remains. It has been applied for the painless extraction of roots by damping a small piece of amadou, in size less than a pea, then dipping it in the crystals, painting the neck of the tooth and the gum around, and letting the crystals dissolve in the natural secretion, keeping away an excess of saliva with pads of lint or amadou. This has been found in a few minutes to deaden sensation sufficiently for the elevator and forceps to be used without much pain, although the patient was conscious of the sensation of the operation. More experience in the use of the drug, however, is required to warrant the conclusion that this concentrated application can safely be made without causing subsequent inflammation or sloughing. No record of its employment by submucous injection has come under our notice. It is possible that injecting a 4-per cent. solution on each side of the tooth to be extracted may produce sufficient local anæsthesia. This operation, however, has its drawbacks, as the very insertion of the needle would be dreaded almost as much as the extraction itself. In excavating the caries from a very sensitive tooth, the 20-per-cent. solution has produced very varying results, in some cases allaying the tenderness, in others without effect. It has also been used for capping exposed nerve pulps, as it is known to be antiseptic as well as anæsthetic. The *Dental Cosmos* for December contains the experiences of one or two well-known operators in America, who had found marked relief to result in very sensitive cavities by the use of cocaine, and they point out that the cavities should be made quite dry, then the cocaine applied for a few minutes and the cavity again dried, when the sensitiveness seemed to be much lessened. It had also been found useful for deadening the excessive sensibility of the contents of root canals when clearing them of the remains of the nerve pulp. One of these gentlemen reports his successes and failures to

be about equal. As a general result, from these and other experiments, it may be concluded that cocaine is without doubt of much value in dental surgery, but the complete *rationale* of its most successful use is as yet undecided. Mr. Brunton, of Leeds, recommends the citrate of cocaine in a pasty condition for allaying the sensitiveness of dentine.—*The London Lancet*, January 24th, 1885.

REPORTS FROM PRIVATE AND CLINICAL PRACTICE.

REPORT 1.*—Prof. W. H. Morgan, of the Dental Department, Vanderbilt University, Nashville, Tenn., on December 13th, 1884, conducted a brilliant clinic, in the presence of members of the faculty, and an enthusiastic class. The first case was an inferior wisdom tooth, overgrown with inflamed and exquisitely sensitive gum tissue. A drop of a four-per-cent. solution of muriate of cocaine was applied to the sensitive structure on a bit of cotton, and at the expiration of four minutes the parts were freely incised, and the patient felt no pain.

The second case was an exposed and highly inflamed tooth pulp (nerve). The anæsthetic was applied as before, and, after the lapse of $3\frac{1}{2}$ minutes, the professor thrust his instrument into and tore away a portion of the offending organ, while a pleased and gratified expression played about the patient's countenance. The professor announced that this was ordinarily one of the most painful operations in all minor surgery.

The third case was the extraction of a superior second molar, a firmly attached tooth, though ulcerated. In this case a small rope of cotton was wound around the tooth, saturated with about two drops of a five-per-cent. oleate of cocaine, and brought in contact with the gums, waiting seven minutes for complete absorption. The tooth was extracted without causing the slightest pain.

The fourth and last case was an inflamed cavity, the result of rapid decay, and which could not tolerate the touch of an instrument. After a five minutes' application of the five-per-cent. oleate the cutting and removal of the decayed tooth bone was accomplished without the least pain.

One could not witness the series of operations without a feeling of awe and admiration, the result seemed so like magic.

It has been contended by physicians and scientists that the new anæsthetic, hydrochlorate of cocaine, being local in its effects, could not be used satisfactorily in the extraction of teeth without pain. Dr. J. F. Stephens made a test of this matter which proved highly successful. He extracted five teeth for a lady, and she said that, though her face was very sore from long suffering, she felt no pain whatever after the anæsthetic was applied.

REPORT 2.†—From reading the proceedings of the Ophthalmological Congress in Heidelberg, I was induced to procure a quantity of the above drug sufficient for making a fair test of its merits as a local anæsthetic to sensitive dentine, as well as for extracting teeth and other operations on the mouth. The solution I have is a four-per-cent. solution. My first experiment was on a first left inferior molar that had ached twice at intervals of about ten days. The first spell there was no treatment; but the last was so severe the patient could stand it no longer. The tooth was treated with oil of cloves, and an engagement made for next day.

When the patient came, I dried the cavity and inserted a piece of cotton, saturated with the solution, and allowed it to remain ten minutes. Removed major portion of decayed dentine with but little pain. Made a second application, and allowed it to remain ten minutes; the excavation was then completed with but slight, if any, pain, and the tooth

* From the Nashville, Tenn., *American*.

† H. E. Beach, in the *Dental Headlight*.

filled with ox. ph. This was on the 22d of November, and there has been no trouble there since.

Case 2.—A lady about 35, with extensive decay between first and second superior bicuspid on right side, with epuloid tumor filling the larger of the two cavities in second bicuspid. It was very tender to the touch, so much so that the patient said it was like sticking a knife through the brain. Made three applications; the first being very painful, the second slightly so, and the third application there was no pain at all. In 15 minutes from first application, I removed tumor with a spoon-shaped excavator, and applied the rubber dam, without the slightest pain. Made another application to the cavities, and excavated with but slight, if any, pain. The pulp in second bicuspid was largely exposed, but was so completely anæsthetized as to give absolutely no pain. I capped the pulp in the usual way and filled with ox. ph.

Case 3.—A lady of nervous temperament, with inflammation of peridental membrane of right inferior wisdom tooth, crown all broken down, and very sore to the touch. Gums soaked in muriate of Cocaine for fifteen minutes and roots removed; no feeling in the gums while pressing the forceps down, but very little, if any, diminution of pain in removing roots, or after removal.

Case 4.—A lady of unusually nervous temperament, but strong will and clear discriminating powers, with second superior bicuspid distal surface extensively decayed, and exceedingly sensitive. Three applications in 15 minutes relieved all sensitiveness, and the whole operation was completed without further trouble.

REPORT No 3.*—I have used cocaine twice in the extraction of teeth, and in each case the operation was for a single tooth. The preparation used was 2 per-cent. solution. In the first case the tooth was exquisitely tender, and the gum inflamed, and so closely adherent to the tooth that it was necessary to incise it. After carefully drying the gum, a small camel's-hair brush was dipped into the solution, and the gum on either side of the tooth brushed across a few times. This was repeated twice at intervals of three minutes, making three applications in all. A few minutes later the gum lancet was used, with almost no pain at all. The tooth was then extracted with a little less pain than it could have been without the anæsthetic. The second case was similar to the first, and the solution was applied in the same manner, with two additional applications. After cleansing the incision from blood, a few drops of the solution were instilled into it, and repeated once after about three minutes. No pain attended the incision, and the tooth was extracted with considerably less pain than in the first case.

REPORT No. 4.†—At our clinic this morning, at the Baltimore College of Dental Surgery, the oleate of cocaine was used in five cases, as follows:

Case 1.—Extraction of an upper dead wisdom tooth—the oleate being applied to the gum around the tooth on a pellet of cotton wool for ten minutes. The tooth was extracted without difficulty, and there was absolutely no pain felt when the tooth was grasped. The beaks of the forceps were pushed well up under the gums. There was some pain at the moment of lifting the tooth from its socket. I consider the drug as a success.

Case 2.—Second inferior bicuspid, left side. A hypodermic injection of ten drops of a four-per-cent. solution muriate cocaine was made just over the anterior mental foramen, before the bicuspid to be removed, and the gum and the neck of the tooth painted three times with the same. There was but slight pain on extracting the tooth.

Case 3.—Two lower roots. Applied the oleate by means of cotton wool—time, ten minutes. No pain from removing anterior, but there was considerable from removal of posterior root. This was owing, in my opinion, to the fact that this root was very much

* Dr. C. H. Shears, in the New York Medical Record, Dec. 18, 1884, p. 657.

† Professor Coyle, of the Baltimore College of Dental Surgery.

decayed out, and was below the gum, which had become very much hypertrophied, and the delay in removing the prong, which was accomplished with an elevator.

Case 4.—A cavity of decay on buccal surface of right lower wisdom tooth. Extremely sensitive. The oleate was applied on a pellet of cotton for ten minutes, when I prepared the cavity for filling, using dental engine with burs, also excavators. Complete absence of sensitiveness was the result in this case.

Case 5.—Was a case of exposed dentine, caused by excision of the gum on buccal surface of first right lower molar. Extremely sensitive to the slightest touch. The oleate was applied as in case 4. While there was not complete abrogation of pain, the patient was enabled to submit to polishing and burnishing the surface. From the result of this clinic I am disposed to believe that, in a large number of cases, cocaine will act as a successful local anæsthetic. I propose to continue experiment in the direction of the hypodermatic application.

REPORT No. 5.*—Regarding my experience with cocaine in dental surgery, I would say I have used it in about thirty cases where the tooth I was working upon was so sensitive to the touch of the excavator (or dental engine), that the pain was unbearable to the patient. Drying the cavity by the means of bibulous paper and hot air, I insert one or two drops of the four-per-cent. solution and wait four minutes; I am thus enabled, in the majority of cases, to excavate thoroughly without a particle of pain. I am unprejudiced when I say that in the majority of cases the cavities were so unfavorably situated that the saliva had the opportunity of commingling with the cocaine, thus helping to destroy the anæsthetic effect. I firmly believe that when there is complete exclusion from moisture, and no aggravated, inflamed condition of the pulp, the dental surgeon can, with this drug, excavate and fill teeth without pain, and this alone is a great boon to suffering humanity. I would say that in one case of necrosis of the superior maxillary, right side, extending from the canine to the front molar, I removed the necrosed portion, including the bicuspid, without pain, applying about a quarter drachm of the 4-per-cent. solution.

In the treatment of several abscesses where the surrounding tissues were exquisitely sensitive to the touch, and highly inflamed, I have had complete success in painlessly lancing them after using the 5-per-cent. oleate of cocaine.

REPORT No. 6.†—In my practice a 2-per-cent. solution of hydrochlorate of cocaine has in many instances produced marked anæsthetic effects when applied to dentine; but almost as frequently it failed to produce any perceptible result. I afterwards resorted to a 10-per-cent. solution with the hope of obtaining uniform results, but was entirely disappointed, and after returning to the use of a 4-per-cent. solution, have obtained better effects than I did with the 10 per-cent. solution, and about the same as were produced by the first solution used. I consider the use of cocaine an invaluable adjunct in dental practice, it is frequently of great service in relieving pain when used as above indicated, and is, of course, much more uniform in its effects on the soft tissues of the gums, etc. It is applicable also by hypodermic injection, as has already been proved, and I do not doubt that means will be found to effect the hard dental tissues by sealing it up in carious cavities in teeth.

REPORT No. 7.‡—At the semi-annual meeting of the Executive Committee and the Board of Examiners of the New Jersey State Dental Society, held January 9, at the residence of the president, J. W. Scarborough, of Lambertville, N. J., a trial was made of the 4-per-cent. solution and 5-per-cent. oleate of cocaine, and in the presence of all of the

* Chas. A. Meeker, D. D. S., Secretary of the Executive Committee and Board of Examiners of the New Jersey State Dental Society.

† J. Morgan Howe, M.D., New York.

‡ Chas. A. Meeker, D. D. S., Secretary.

members the anæsthetic effect of both preparations on the inflamed and exceedingly sensitive gum surrounding an ulcerated lower first molar, was proven by several severe tests, and after nine minutes application of the 5-per-cent. oleate of cocaine the forceps was easily and painlessly adjusted, although pain was felt when the tooth was extracted.

REPORT NO. 8.*—The dental uses of cocaine hydrochlorate are still the subject of experiment, and I do not wish to speak too positively of its future. But I had marked success in perhaps a dozen cases where it was applied to the exposed pulp, and I think it will become a standard application for this purpose. It is very useful in rendering the gums insensible to cutting or pressure, as in removing calculus or adapting the rubber dam. I have had no satisfactory results from its application to dentine, but now and then a little relief. On the whole, I do not think dentists will be able to dispense with this medicine.

REPORT NO. 9.†—This afternoon (Jan 29, 1885) the oleate of cocaine, 5-per-cent., was applied to the left inferior first molar in my mouth by Brooks Rutledge, operator. The tooth had been too sensitive to excavate with any kind of an instrument for over a year. The cavity could not even be touched with a toothpick, the dentine was so very sensitive. After applying the oleate, the dental engine was used with very little pain, and the cavity prepared for a filling of gold, work which had been attempted twice before without my being able to tolerate it.

REPORT NO. 10.‡—A young girl about 12 years of age came to my office with a large cavity in a central incisor, with the nerve pulp very badly exposed. After the cofferdam was applied, and the cavity dried, I made an application of the 4-per-cent. solution of cocaine, and in a few minutes I was enabled to remove a portion of the nerve pulp, and fill the tooth without any pain or knowledge of the operation I had performed.

REPORT NO. 11.§—Cocaine has been used here in dental surgery, and Dr. W. Halstead has, by means of injection of a 4-per-cent. solution (and even one of greater strength) with a curved point caused anæsthesia of the inferior dental nerves. Several operations have been performed without discomfort to the patient, and one dentist has filled teeth quite painlessly.

REPORT NO. 12.§—Dr. G. W. Weld, D.D S., believes that the best method of application of muriate of Cocaine in the operation of removing tartar from the teeth, in Rigg's disease is as follows: Wash the gums with a little dilute alcohol; then apply, by means of a camel's-hair brush, a small quantity of a ten-per-cent. solution of the cocaine. Renew this once or twice, when in the course of five minutes it will be found that there is a marked numbness and diminution in the sensibility of the gums corresponding to the sides of the teeth on which the application was made. The following formula is recommended:

℞ Cocaini hydrochloratis.....	gr. vj.
Spiritus menthæ piperitæ.....	3j.

An exposed nerve pulp was treated with the above solution, and partially extirpated, without causing any pain to the patient. In the preparation of an extremely sensitive tooth for filling, a *glycerite, ninety per cent.* in strength (made by dissolving crystals of cocaine muriate in glycerine) was allowed to remain in the cavity for a period of 30 minutes. On renewing the operation, the patient stated that the pain was materially deadened. The same experiment was tried with the borate of cocaine (Foucar's crystals), and similar results apparently obtained, but the paste was permitted to remain in the cavity of the tooth for twenty-four hours.

* J. Smith Dodge, Jr., 15 W. 20th St., New York City.

† T. M. Comegys, a student in the University of Maryland, from Brownsville, Tenn.

‡ Worthington Pinney, D.D.S., 72 Park Place, Newark, N. J.

§ Medical News, Jan. 3, 1885.

§ New York Medical Record, Dec. 13, 1884, p. 657.

COCAINE IN GENERAL DISEASES.

COCAINE IN THE TREATMENT OF THE ALCOHOL AND OPIUM HABITS, AND AS AN ANTIDOTE IN CASES OF OPIUM POISONING.

The extensive study of the effects of cocaine and its salts, which has resulted from the discovery of the anæsthetic power of cocaine hydrochlorate, has brought into prominence the therapeutic value of this drug in the treatment of the opium and alcohol habits.

While the stimulant and tonic effects of coca and its derivatives have long been recognized as being of value in counteracting the depressant effects of opium and alcohol, it has remained for recent experimenters to claim that in cocaine we have a remedy, whose physiological action and therapeutic effects, as recorded by competent observers, leave no doubt as to its great efficacy in the treatment of the alcoholic habit, its almost specific action in affording relief to the victims of the opium habit, and its antidotal effect in cases of poisoning by opium and its preparations.

In an article by E. Merck, published in the *Klinische Monatsblätter für Augenheilkunde* Zeherden for October, 1884, a translation of which subsequently appeared in the *Chicago Medical Journal and Examiner*, February, 1885, it is stated that Professor E. Fleischl and Dr. Sigm. Freud, of Vienna, have carefully studied the action of cocaine, and as a result of their observations, have determined that this drug has proved itself to be an invaluable aid against the continued use of morphia and also *against a single fatal dose*.

These experimenters have given the medicine in the form of its muriatic acid combination, in doses of 0.05 to 0.15 gramme, and as much as 0.5 gramme in a watery solution has been given per day.

Merck further remarks that cocaine has its greatest future in morphia and alcohol abstinence that it apparently paralyzes the morphine hunger of the opium eater, relapses do not occur, and depression and nausea do not take place during the cure.

In case of gradual or long continued withdrawal of opium, decreasing doses of morphia and increasing doses of cocaine are given. In cases of absolute and sudden abstinence, doses of 0.01 of a gramme are injected subcutaneously as often as the morphine hunger is felt. Confinement in institutions becomes quite unnecessary with this method.

Dr. Freud, who, with others saw such a case after 10 days of cocaine treatment (0.01 gramme subcutaneously three times a day) pass into positive convalescence, is of the opinion that a direct antagonism exists between morphine and cocaine.

Prof. Fleischl confirms Dr. Freud's statement, recommending the gradual withdrawal of morphine and a gradual increase of cocaine, and that in case of sudden abstinence from

morphine, a radical cure can be effected in ten days, by an injection of 0.01 of a gramme of cocaine three times a day, and further adds with reference to the value of cocaine in treating the alcohol habit, *that inebriate asylums can now be entirely dispensed with.*

If these claims are substantiated by more mature observation, and cocaine should prove to be, as the facts recorded would now indicate, the long sought for specific for the opium habit; the reliable antidote in poisoning by opium preparations; and the invaluable stomachic and tonic in alcoholism, it will indeed be the most important therapeutic discovery of the age, the benefit of which to humanity will be simply incalculable.

THE USE OF COCAINE IN NERVOUS AFFECTIONS.

At the recent meeting of the American Neurological Association, Dr. J. K. Bauduy, of St. Louis, read a paper in which he recounted his experience with the use of cocaine in the treatment of certain forms of psychical disturbance. We expect to publish Dr. Bauduy's paper shortly. In the meantime, we would call attention to a letter which has been shown us, written by Dr. L. Bremer, of St. Louis, from which we make the following extracts: "Dr. Bauduy, of this city, has been using the cocaine in cases of melancholia with the happiest results. During a recent visit at St. Vincent's Hospital I was, by the kindness of the doctor, afforded an opportunity of witnessing the rapid and wonderful effect which the hypodermic injection of one grain of the drug produced in the affection named. W. H., aged seventeen, who was under my treatment before his admission to the hospital, for hebephrenia, and whose mental state I am thoroughly familiar with, was, on our visit, found in a condition of great depression. Although he knew me well, he refused to speak to or recognize me. The expression of his face was that of utter dejection, despair, and disgust. All efforts to elicit an answer to my questions failed; he remained wrapped up in a sullen silence. The injection of one grain of cocaine changed the scene as by magic. Four minutes after the introduction of the drug the patient began to talk; the spell was broken, and he conversed freely and intelligently on the nature of his trouble. The almost mathematical precision of the effect of the remedy could only be compared to that of morphine in certain nervous affections.

"The second case in which the cocaine was tried in my presence, and yielded a like brilliant result, was that of a young man suffering from a severe form of melancholia combined with a refusal to take nourishment. Five minutes after the administration of the drug he became quiet and partook readily of the nourishment offered him. This patient would never eat except when under the influence of the drug; it was applied for the first time when he was approaching inanition, to avert which the feeding-tube was thought of as a last resort. . . . To my knowledge, Dr. Bauduy has been the first to try cocaine in melancholia."

Dr. Bauduy seems to have been the first also to suggest the use of cocaine for the morning sickness of pregnancy. An interesting account of Dr. Scenck's experience with the remedy for that distressing condition will be found in the report of the proceedings of the St. Louis Medico-Chirurgical Society, published in the St. Louis Courier of Medicine for May, where it is expressly stated that the cocaine was used at the suggestion of Dr. Bauduy.—*N. Y. Med. Journal.*

ERYTHROXYLON COCA IN DISEASES OF THE SKIN.

Dr. John V. Shoemaker, at a recent lecture, delivered at the Philadelphia Hospital for Skin Diseases, spoke of the treatment of certain cutaneous affections by the topical application of the fluid extract of erythroxylon coca. The hospital record shows that both preparations have been successfully used, for the past two years, in cases of

eczema, dermatitis, herpes, herpes zoster, rosacea, urticaria and paræsthesia. A case of acute eczema of the ear and neck was shown which was improving on the local application of one ounce fluid extract erythroxyton coca to three ounces of water. It was ordered in the same way in a case of dermatitis of both arms. In rosacea of the first stage, in which the nose and cheeks were involved, three drachms of the extract of erythroxyton coca was prescribed to one ounce of lard. It was also applied in a case of perverted sensibility of great irritation of the integument of the lower limbs of an old patient brought before the class. The lecturer stated that the fluid extract and extract of erythroxyton coca, which he had employed now for more than two years, had a most decided sedative action upon irritable conditions of the integument, used either alone or combined with other suitable remedies which may be indicated.—*Med. Bulletin of Medicine and Surgery*, December, 1884.

COCAINE AS A LOCAL ANÆSTHETIC IN THE USE OF THE THERMO-CAUTERY.*

Though many courageous patients bear even the thorough application of the thermo-cautery with fortitude, there are constitutions that can not endure it, even lightly applied, without intense suffering or nervous shock. I have in the latter class of cases usually employed an anæsthetic internally, but it has often happened that some difficulty of the heart has rendered this impracticable. I have recently employed the cautery in two of these cases, pain being entirely prevented by the local use of cocaine.

The first was that of a gentlemen suffering from chronic cervico-occipital neuralgia with congestion at the base of the brain; there was cardiac neuralgia with feeble and irregular action of the heart. I injected into the neck near where I intended to apply the cautery four drops of a four-per-cent. solution of cocaine, and painted thickly, with several coats of it, the surface to be cauterized; coldness and numbness of the skin were produced. Light applications were freely made with a blunt point of Paquelin's apparatus, the operation being entirely painless; it was, of course, *followed* by burning.

The other instance was that of a very delicate lady who also suffered from heart troubles, rendering the ordinary anæsthetics inexpedient; the case was one of neuritis, the external cutaneous nerve of the arm being affected, causing great pain, some swelling, and loss of power of the arm and of the radial side of the forearm. Three drop's of a four-per-cent. solution were injected near where the nerve perforates the coracobrachialis muscle, and the integument over the region of the biceps was painted with several coats of the solution, producing coldness and numbness of the skin. The cautery was freely used, the patient not suffering in the least.

There is every reason why, in such cases as cauterization of the superficial layers of the skin, cocaine should be of special use, since by it cutaneous insensibility can be easily induced. As regards the desirableness of some pain being felt during the operation, this can be graduated by the quantity of cocaine used. The burning, erythema, congestion, etc., are just as great afterward, however, as if cocaine had not been employed.

COCAINE IN NEURALGIA.†

During the last three weeks I have used cocaine in six cases of supra-orbital neuralgia, with an amount of success which I think justifies a further trial of this mode of treatment. I commenced by rubbing in a four-per-cent. aqueous solution of the hydro-

* Henry B. Millard, M. D.

† William Murrell, M.D., F.R.C.P., Assistant Physician to the Westminster Hospital, etc.

chlorate of cocaine, but no beneficial effect was produced, and it was clear that absorption did not take place. I next tried a hypodermic injection over the painful spot, of first an eighth, then a quarter, and finally half a grain of the same solution. The relief was almost instantaneous, and lasted from twelve to twenty-four hours, according to the dose employed; but the objection to this mode of treatment is the pain caused by the introduction of even a clean sharp needle. I abandoned this plan, and tried the inunction of first a ten and then a twenty-per-cent. solution in chloroform. This gave fairly good results, but the chloroform evaporates so quickly as to leave much of the salt on the skin. A better solvent is oil of cloves, and I now use a twenty-per-cent. solution of the hydrochlorate in that menstruum. I rub in from five to ten minims with the finger, and find that almost instant relief is afforded. We hear a great deal about the toxic action of the drug, but I have never met with bad symptoms of any kind. The real objection to the treatment is the expense, a hundred minims of the twenty-per-cent. solution costing about £2 10s. In hospital practice it will be found cheaper to employ percussion, which sometimes gives excellent results, or to use a pigment made by rubbing up together equal parts of chloral, menthol, thymol, and camphor.

COCAINE IN SLEEPLESSNESS.

Cocaine (or cucaine, as our English cousins call it,) has been recommended for a variety of purposes, and now Mr. J. Swain reports the following cases in the *Brit. Med. Jour.*, December 20, 1884:

CASE 1.—A man, aged 33, suffering from aortic disease and albuminuria, had been troubled with insomnia for a fortnight. Three minims of a four-per-cent. solution of hydrochlorate of cocaine (equal to $\frac{1}{8}$ of a grain) were administered hypodermically. The patient remarked that "he slept better than he had done for a long time." The following night, one drachm of valoid of coca (a liquid extract, each drachm of which represents an equivalent quantity of the pure drug) was administered. The man did not sleep well. Two drachms of the valoid of coca were then given, and sleep was induced. The patient has continued to take this dose nightly for the past three weeks, the sleep being natural and undisturbed.

CASE 2.—Two drachms of the valoid were given with an equally beneficial result to a patient convalescent from an empyema, and suffering from sleeplessness.

CASE 3.—A woman, with tertiary syphilis, was kept awake by pain in a large rupial sore on the thigh. Two minims of the four-per-cent. solution of the hydrochlorate of cocaine, dropped on the ulcerating surface, relieved the pain, and the patient slept.

To show that coca and cocaine have no toxic action—at all events, in moderate doses—it may be worth mentioning that, in a case of rheumatism, the dose of hydrochlorate of cocaine was gradually increased to six minims ($\frac{1}{4}$ of a grain) hypodermically, and the valoid increased to five drachms, without any bad effect.—*Med. and Surg. Reporter*, Jan. 17, 1885.

COCAINE IN CRACKED NIPPLES.*

As it is the correct thing to use the muriate of cocaine for everything from corns to toothache, and as I have not seen it recommended as yet for fissured or eroded nipples of nursing women, I wish to report that I have found it to be a perfect anæsthetic in these cases. In three such cases a four-per-cent. solution was applied with a small brush, in five minutes a second application was made and five minutes later two of the

* Geo. C. Mecuen, in the *Boston Med. and Surg. Jour.*, Sept. 3, 1885.

patients nursed directly from the nipple, the other using a nipple shield. All experienced a complete relief from pain. Furthermore it did not appear to hinder healing of the part. If time is any object a stronger solution should be used. Washing the nipple before the child nurses seems to make no difference to either mother or child.

COCAINE IN CASES OF FEEBLE HEART.

At a late meeting of the College of Physicians of Philadelphia, Professor DaCosta called attention to the hypodermic use of cocaine in cases of cardiac failure and weak heart. He found that doses of one-third to two-thirds of a grain strengthened the cardiac systole, and, as shown by the sphygmograph, the pulse became fuller, stronger, and a little slower. Given in this way it was observed that the pupils became dilated, but the effect upon sensibility of mucous membranes was only slight, and not comparable to those following its local employment. Injected into the skin it produced a wale which was insensible, but when thrown under the skin no local anæsthesia was produced.—*College and Clinical Record.*

COCAINE IN SENILE GANGRENE.

Owing to its local anæsthetic properties, Dr. John Gould (*Brit. Med. Jour.*, March 28, 1885,) was induced to try the effects of cocaine in a case of senile gangrene, occurring in an active and excitable man, aged 67. He had worked hard, both mentally and physically, and the heart's action was very feeble. About 15 years ago, he had a serious attack of suppressed gout and congestion of the liver, and, some time after this, he suffered from diabetes. He informed him that his father and grandfather both died of gangrene of the feet. He came under Dr. G.'s care suffering intermittently from indigestion and sluggish liver; this was followed by œdema of the feet, and a return of the diabetes, which, under suitable treatment, soon disappeared.

Shortly after this illness, he complained of pain in the second and third toes, which continued to increase, and, at the same time, the toes grew dark in color, eventually becoming unmistakably gangrenous. The gangrene gradually extended to the dorsum of the foot for about three inches; the pain was perfectly agonizing. Amongst other applications, poppy fomentations were tried; linseed poultices saturated with laudanum; painting the part with equal parts of tincture of aconite, opium, and chloroform; also an ethereal tincture of belladonna, none of which gave the slightest ease. At night, the patient had a draught of bromide of potassium and hydrate of chloral, 20 grains of each, with eight grains of Battley's solution of opium; this had frequently to be repeated before sleep could be obtained.

He now thought it to be a fair case for the trial of cocaine, and accordingly applied a four-per-cent. solution of the hydrochlorate, first rubbing it into the sound skin contiguous to the gangrene, and afterwards applying a piece of muslin saturated with the solution. Over all, a piece of gutta-percha tissue was placed, to prevent evaporation, the gangrenous part being dressed with carbolic oil. The result of the first application was highly satisfactory, the pain diminishing considerably; the subsequent applications, made once a day, were followed by a most decided relief, so that half of the night-draught was sufficient to procure sound sleep for many hours.

Of course, cocaine was not used with an expectation that it would either cure, or even arrest the progress of the disease, but with the hope that it might mitigate the excruciating pain, which it did in a most decided and satisfactory manner up to the last, thus affording as much comfort to the friends as it did relief to the suffering patient.—*Med. and Surg. Reporter.*

FAILURES WITH COCAINE.

Dr. F. C. Riley, of New York, makes a report of two cases in ophthalmic practice which demonstrate that the much lauded new remedy is not always as reliable as might be wished.

CASE I.—Granular lids with intense pannus occurring in a girl of ten years. The photophobia in this case was so marked that, upon facing the patient toward the window in an ordinarily well-lighted room, the eye-ball rolled upward and inward to such a degree as to completely hide the whole corneal expanse from view, unless the superior palpebral covering was lifted.

Two drops of a four-per-cent. solution of cocaine was instilled, at intervals of ten minutes, for a period of half an hour, or three instillations in all, with no perceptible effect either as regarded diminution of sensibility to light or touch. Neither was there any appreciable effect produced upon the size of the pupil, nor did the drug affect the circulation so far as it was possible to observe it.

Three days subsequent to the preceding trial, I determined upon operating to relieve the pannus, and again tried the same solution, instilling four drops every five minutes for a period of three-quarters of an hour, or in all, nine instillations. Careful efforts to touch the conjunctiva or cornea at any part thereof, between each instillation, failed to elicit the slightest evidence of anything even approximating a condition of anæsthesia. Feeling that a fair trial had been given the drug in this case, I proceeded to the use of ether and performed syndectomy.

CASE II.—A lad about twelve years of age, who had a perforating ulcer of the cornea about six months since, with prolapsus of iris into the perforation, etc. Cornea almost completely cloudy or pearly. To the outer and upper segment yet remained a small spot of transparent tissue, at which point I deemed it advisable to perform an iridectomy in order to free the entrapped iris, which seemed to produce a constant irritability of the eye. Vision-perception of light only. Using the same solution of cocaine as in the former case, four drops every ten minutes for forty minutes, with absolutely no effect of any kind, either to cornea or conjunctiva, led me to the opinion that the solution was not what it should be. Subsequent results with the same solution have, however, dispelled my suspicion as to the sample used, as I have since obtained all the physiological effects so far noted by other observers. The two cases recorded, however, seem to me to prove beyond the suspicion of a doubt that there are certain conditions, pathological, may be, or individual idiosyncrasies, possibly both, that tend to militate against the verdict so generally expressed thus far in favor of the anæsthetic effects of the drug. It seems to me that in the use of this substance, the cases of failure to obtain the desired end should be placed before your readers as well as the brilliant results obtained by so many of us. That it has been a great blessing to many during its short career there is no doubt, and that it will continue to prevent the attendant pain of many operations in the future I am confident. Even if it gives as universal satisfaction in time to come as it has in my hands thus far, it is indeed a friend to the suffering and distressed.—*Medical Record*.

CAUTION IN THE USE OF COCAINE.*

Dr. Knapp,* in the New York Medical Record for December 13, 1884, first called attention to the precaution which should be observed in the use of the new anæsthetic. His reasons are based upon the symptoms presented by the two following cases:

CASE I.—Six minims of a four-per-cent. solution of cocaine were injected close to

* By James L. Minor, M. D., New York.

the posterior segment of the globe. Anæsthesia was complete, and the operation successful, there being no disturbing element in the recovery. During the operation, however, it was noticed that the patient became pale.

CASE II.—Five minims of a three-per-cent. solution of cocaine were injected beneath a sebaceous tumor of the lid. Anæsthesia was complete, and the somewhat laborious operation was satisfactorily completed; but, during the operation, the patient became as pale as a corpse, felt faint, asked repeatedly for drinks, and was covered with cold perspiration. All of these disagreeable features passed off in fifteen minutes.

Dr. Knapp, while recognizing the safety of injecting larger quantities of cocaine in other parts of the body, suggests that the vascularity of the orbit may allow quicker entrance of fluids injected here into the general circulation than elsewhere, and will hereafter be more cautious in the use of cocaine about the eye—will use one or two minims and feel his way.

The New York *Medical Record*, for January 17, 1885, under the head of "Disagreeable Experiences with Cocaine," refers to numerous communications from correspondents, relating more or less disagreeable or alarming experiences with this drug—some of which appear in its columns. Dr. E. S. Peck, of New York, has had the same experience as Dr. Knapp in operating for squint, under cocaine, in the person of a young lad. A four-per-cent. solution was used, and during the operation, was noted "increasing pallor of the face, together with a profuse, beady perspiration." This was at first attributed to apprehension or pain, but as no pain was experienced, it is thought to have been due to the drug.

Dr. George T. Stevens, of New York, injected four minims of a three-and-a-half-per-cent. solution of cocaine over the course of the rectus internus, preparatory to advancement of this muscle, in the person of a very nervous man. The operation was performed without pain, and ten minutes later the patient had convulsions, difficult breathing, loss of consciousness, and a livid face. All of these symptoms passed off in half an hour, and nothing out of the way could be discovered by a careful examination of the man, further than dilatation of the pupil ad maximum on the operated side. He refers to Dr. Knapp's observations, and suggests that the proximity of the orbit to the large nervous centres may, in part, account for the disagreeable symptoms.

Dr. E. C. River, of Denver, Col., reports the case of a man operated upon for strabismus under cocaine, where six drops of a four-per-cent. solution had been instilled into each eye. After completion of the operation the patient complained of nausea and a feeling of faintness, the face became pale, the hands cold, and the skin covered with cold perspiration; pulse 48. All of these symptoms passed off in a few minutes. The next day cocaine was used as before, without unpleasant effects. The patient said the distress previously experienced was due to the knowledge he had that he was being cut, though he had no pain. He had fainted on a former occasion while witnessing an operation.

The enthusiasm of success on the one hand, and the suspicion of novelty on the other, are two factors which greatly influence us in our estimates as to the value of all new remedies. Should the former outweigh the latter, prominence is quickly gained. A preponderance of the latter delays proper appreciation and recognition. Occasionally, however, they counterbalance, and correct opinions are then quickly gained; but usually this process of vacillation continues to make belief uncertain long after the question should have been definitely settled.

The unusual success which has been accorded to cocaine has given it impetus enough to override much that has been said against it—and I would fain call attention to such effects as the above, which have been ascribed to cocaine, and ask if the

suspicious pointing to this agent as the cause have not been as premature as they are unjust.

Few operators in minor surgery have failed to observe the train of symptoms narrated above during operations without an anæsthetic. Nay, more, the sight of instruments or of blood, or the mere description of an operation, will at times bring on the various stages of fainting, which may culminate in the patient's falling senseless to the floor in a state of syncope. And in another class of individuals—nervous and excitable—such surroundings will bring on hysterical phenomena, simulating as strongly serious disorders, as they are in themselves harmless. Having shown that it is not necessary to go so far as cocaine for an explanation of phenomena which have been observed during its use, it will be superfluous to state that physiological research has failed to reveal such properties as have been attributed to it upon the operating table. That cocaine can be used about the orbit with comparative impunity, it will suffice to say that three cases of enucleation which I am familiar with have been performed at the New York Eye and Ear Infirmary under its influence, the amount of the drug used being about 3jss of a four-per-cent. solution in each instance. Two of these cases occurred in the practice of Dr. D. C. Cocks, the other two in my own, where the house surgeon, Dr. L. P. Walker, operated, and Dr. Walker informs me that he has a second case. No untoward symptom was noted in either of these four cases.

The importance of cocaine can hardly be over-estimated, yet it has its limitation; and not an unimportant one is the the mental impressions which grow from a knowledge of what is going on during an operation performed under its influence. Local anæsthesia does not necessarily bring mental quietude and self-control, and if these two latter conditions are absent, the imagination is apt to play an important role in any operation undertaken. Whether a prominent feature or not, the imagination must always be considered in operations performed without a general anæsthetic.—*Medical Record*, February 7, 1885.

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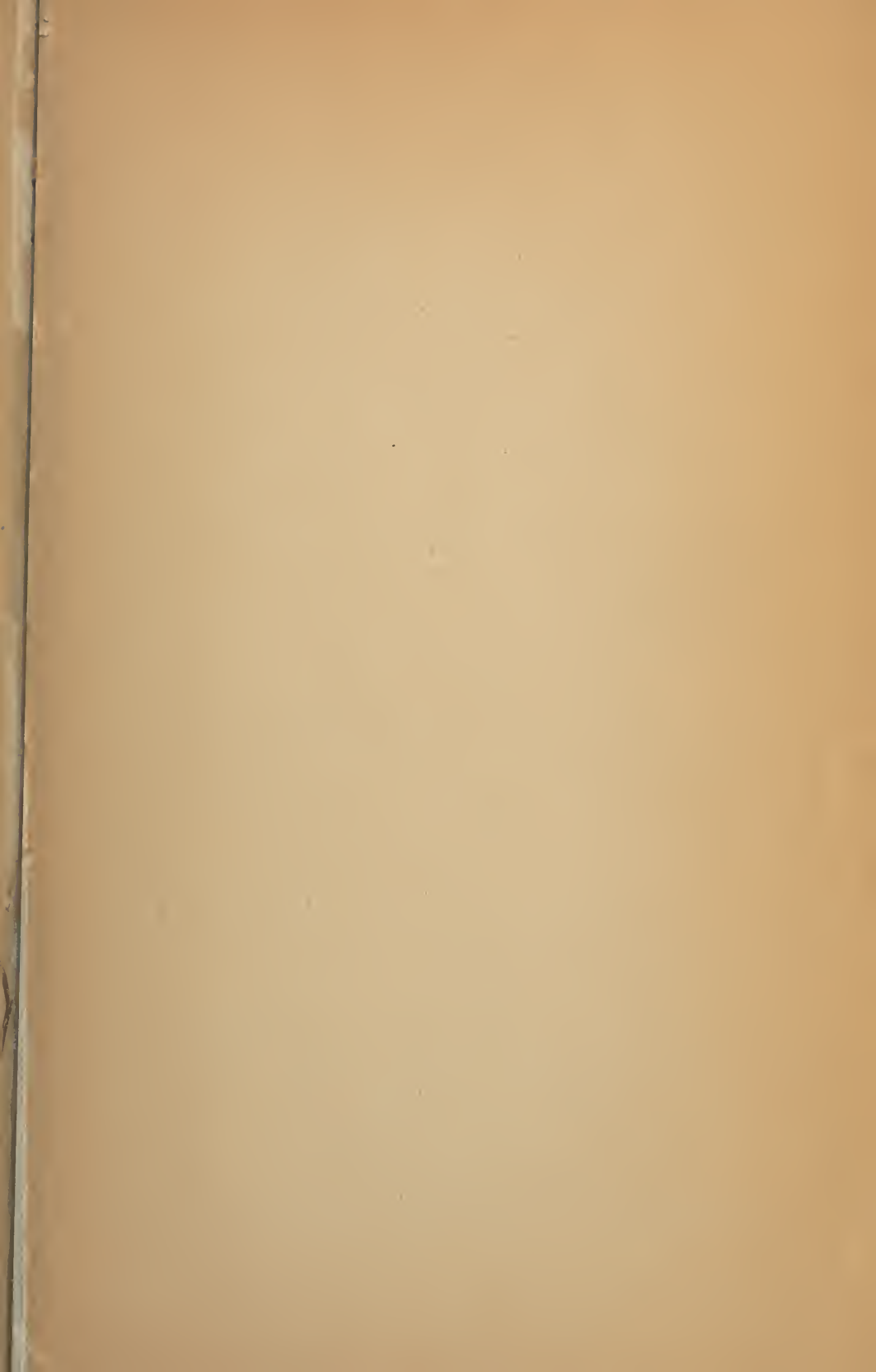
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